Waterford Public Schools

Technology Education Curriculum
Grades 6-12

Revised 2016

TABLE OF CONTENTS

CURRICULUM REVISION COMMITTEE

William Armitage	*Design Technology* *Multimedia*
Walter Canova	*Transportation* *Advanced Transportation* *Auto Mechanics Fundamentals* *Advanced Auto Mechanics*
Allan Carbee	*Woodworking* *Advanced Woodworking* *Photography* *Advanced Photography* *Graphic Communications*
Christopher Cassidy	*Drafting/CAD I* *Drafting/CAD 2* *Architectural Drafting* *Advanced Drafting* *Construction Engineering* *Innovation in Engineering* *Fundamentals of Land Surveying* *Computer Science* *Mobile Computer Science*
David Jarzabek	*Residential Construction* *Intro to Web Site Development* *Advanced Web Site Design* *Video Production* *Advanced Video Production*

DEFINITION

Technology Education is a hands-on, action-based program designed to further a student's technological literacy, explain existing transportation, communication, production, and construction systems, develop the student's confidence in critical thinking and problem-solving situations, to link fundamental academic disciplines, and to provide those valuable skills necessary to be a life-long learner.

PHILOSOPHY STATEMENT

Technology Education is a formal discipline that reflects the distinctive technological character of society. It is a hands-on, action-based program for all students who are concerned with the manner in which humans make use of transportation, communication, production, and construction systems to adapt their environment for social, economic, and environmental purposes.

Technology Education engages students in problem solving and decision making, while interfacing with the content of other disciplines. In the world of formal knowledge, the sciences, humanities, mathematics, and technology disciplines support and complement one another. Therefore, the total education of an individual can be complete only when the parts are understood as they relate to the whole.

Technology education has a unique place in the total learning experience of the student. The intent is to provide a balanced mix of theoretical, historical, and practical information to students. Through a student's involvement in a Technology Education program, s/he will develop a technological literacy which will enhance the total educational experience of the individual.

DEPARTMENTAL GOALS

The students will have the opportunity to:

- ***Develop a fundamental knowledge about the evaluation of technology and its effect on people, their culture, and the environment.***
- ***Assist in developing insights, understandings, and applications of technological concepts, processes, and systems.***
- ***Develop an understanding of the interrelation of technology, the sciences, mathematics, language arts, history, social studies, and the fine arts.***
- ***Develop and refine cognitive and psychomotor skills through research, design, production, and analysis of technological systems.***
- ***Develop problem solving and decision making abilities involving human and material resources, processes, applications, and technological systems.***
- ***Gain career awareness through an understanding of individual skills and interests as they relate to the technologies used by various occupations.***

STATE OF CONNECTICUT TECHNOLOGY EDUCATION STANDARDS

ESSENTIAL KNOWLEDGE AND SKILLS (GRADES 6-12)

EKS.01	**Complete required training, education, and certification to prepare for employment in a particular career field.**
EKS.01.01	Identify training, education and certification requirements for occupational choice.
EKS.01.02	Participate in career-related training and/or degree programs.
EKS.02	**Demonstrate language arts knowledge and skills required to pursue the full range of post-secondary education and career opportunities.**
EKS.02.01	Model behaviors that demonstrate active listening.
EKS.02.02	Organize oral and written information.
EKS.02.03	Compose focused copy for a variety of written documents such as: agendas, audio-visuals, bibliographies, drafts, oral presentations, reports, and technical terminology.
EKS.02.04	Evaluate oral and written information for: accuracy, adequacy/sufficiency, appropriateness, clarity, conclusions/solutions, fact/opinion, propaganda, relevancy, validity, and relationship of ideas.
EKS.02.05	Present formal and informal speeches including: discussion, information requests, interpretation, and persuasive arguments.
EKS.03	**Demonstrate mathematics knowledge and skills required to pursue the full range of post-secondary education and career opportunities.**
EKS.03.01	Demonstrate use of relational expressions such as: equal to, not equal, greater than, less than, etc.
EKS.03.02	Apply data and measurements to solve a problem.
EKS.03.03	Analyze Mathematical problem statements for missing and/or irrelevant data.
EKS.03.04	Construct charts/tables/graphs from functions and data.
EKS.03.05	Analyze data when interpreting operational documents.
EKS.04	**Demonstrate science knowledge and skills required to pursue the full range of post-secondary and career education opportunities.**
EKS.04.01	Evaluate scientific constructs including: conclusions, conflicting data, controls, data, inferences, limitations, questions, sources of errors, and variables.
EKS.04.02	Apply scientific methods in qualitative and quantitative analysis, data gathering, direct and indirect observation, predictions, and problem identification.
EKS.05	**Employ critical thinking skills independently and in teams to solve problems and make decisions (e.g., analyze, synthesize and evaluate).**
EKS.05.01	Identify common tasks that require employees to use problem-solving skills.

EKS.05.02	Analyze elements of a problem to develop creative solutions.
EKS.05.03	Describe the value of using problem-solving and critical thinking skills to improve a situation or process.
EKS.05.04	Create ideas, proposals, and solutions to problems.
EKS.05.05	Evaluate ideas, proposals, and solutions to problems.
EKS.05.06	Use structured problem-solving methods when developing proposals and solutions.
EKS.05.07	Generate new and creative ideas to solve problems by brainstorming possible solutions.
EKS.05.08	Critically analyze information to determine value to the problem-solving task.
EKS.05.09	Guide individuals through the process of recognizing concerns and making informed decisions.
EKS.05.10	Identify alternatives using a variety of problem-solving and critical thinking skills.
EKS.05.11	Evaluate alternatives using a variety of problem-solving and critical thinking skills.
EKS.06	**Implement personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments.**
EKS.06.01	Assess workplace conditions with regard to safety and health.
EKS.06.02	Align safety issues with appropriate safety standards to ensure a safe workplace/jobsite.
EKS.06.03	Identify safety hazards common to workplaces.
EKS.06.04	Identify safety precautions to maintain a safe worksite.
EKS.06.05	Select appropriate personal protective equipment as needed for a safe workplace/jobsite.
EKS.06.06	Inspect personal protective equipment commonly used for selected career choice.
EKS.06.07	Use personal protective equipment according to manufacturer rules and regulations.
EKS.06.08	Employ a safety hierarchy and communication system within the workplace/jobsite.
EKS.06.09	Implement safety precautions to maintain a safe worksite.
EKS.07	**Employ leadership skills to accomplish organizational goals and objectives.**
EKS.07.01	Exhibit traits such as empowerment, risk, communication, focusing on results, decision-making, problem solution, and investment in individuals when leading a group in solving a problem.
EKS.07.02	Exhibit traits such as compassion, service, listening, coaching, developing others, team development, and when acting as a manager of others in the workplace. Understanding and appreciating others
EKS.07.03	Exhibit traits such as enthusiasm, creativity, conviction, mission, courage, concept, focus, principle-centered living, and change when interacting with concept, focus, principle-centered living, and change when interacting with others in general.
EKS.07.04	Consider issues related to self, team, community, diversity, environment, and global awareness when leading others.

EKS.07.05	Exhibit traits such as innovation, intuition, adaptation, life-long learning and coachable to develop leadership potential over time.
EKS.07.06	Analyze leadership in relation to trust, positive attitude, integrity, and willingness to accept key responsibilities in a work situation.
EKS.07.07	Describe observations of outstanding leaders using effective management styles.
EKS.07.08	Participate in civic and community leadership and teamwork opportunities to enhance skills.
EKS.08	**Identify and demonstrate positive work behaviors and personal qualities needed to be employable.**
EKS.08.01	Demonstrate self-discipline, self-worth, positive attitude, and integrity in a work situation.
EKS.08.02	Demonstrate flexibility and willingness to learn new knowledge and skills.
EKS.08.03	Exhibit commitment to the organization.
EKS.08.04	Identify how work varies with regard to site, from indoor confined spaces to outdoor areas, including aerial space and a variety of climatic and physical conditions.
EKS.08.05	Apply communication strategies when adapting to a culturally diverse environment.
EKS.08.06	Manage resources in relation to the position (i.e. budget, supplies, computer, etc.).
EKS.08.07	Identify positive work-qualities typically desired in each career.
EKS.08.08	Manage work roles and responsibilities to balance them with other life roles and responsibilities.
EKS.09	**Demonstrate skills related to seeking and applying for employment to find and obtain a desired job.**
EKS.09.01	Use multiple resources to locate job opportunities.
EKS.09.02	Prepare a résumé.
EKS.09.03	Prepare a letter of application.
EKS.09.04	Complete an employment application.
EKS.09.05	Interview for employment.
EKS.09.06	List the standards and qualifications that must be met in order to enter a given industry.
EKS.09.07	Employ critical thinking and decision-making skills to exhibit qualifications to a potential employer.

DESIGN TECHNOLOGY
GRADE 6

Sixth grade students participate in Clark Lane's Technology Education course as part of their Unified Arts experience. Students attend lab sessions for one trimester of the school year on an alternating day basis for approximately thirty contact periods. The course centers on S.T.E.M. activities which focus on "Energy and Motion." Students gain an understanding of Bernoulli's and Archimedes' Principles as well as Newton's Laws of Motion and Energy Conservation while participating in hands-on activities. Students are also exposed to basic coding skills using Terrapin LOGO software to program PRO-BOT vehicles. Additional projects may include the construction, programming and testing of small devices and structures for load carrying efficiency and crash testing of "Space Capsules".

DESIGN TECHNOLOGY
GRADE 6

UNIT 1: HEAVIER THAN AIR CRAFT - "WHITE WING GLIDER"

Objectives

Students will explain Bernoulli's and Archimedes' Principles as they related to flight.
Students will identify the four forces of flight (thrust, lift, weight and drag) and explain how each force impacts the duration of flight.
Students will follow a sequential set of instruction to construct a completed airplane.

Essential Questions

Why do airplanes fly?
What are the four forces of flight?
How does Bernoulli's Principle explain how the shape of an airplane wing generates lift?
How has air flight impacted our lives?
What careers are associated with the airline industry?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Lift is generated by a decrease in the density of the air which travels over the wing.	Students will construct a balsa wood glider using supplied materials and teacher instructions. Test flights will take place on the CLMS athletic field and flight data will be collected and analyzed. Students will be given a reading assignment to summarize with focuses on the impact of air transportation upon our lives.	Performance on student evaluation Classroom performance
The ability to fly has expanded the human experience. We now have the ability to transport people and material over great distances in short periods of time.		
The airplane has made the world a much more accessible place.		

DESIGN TECHNOLOGY
GRADE 6

UNIT 2: BUOYANCY - "PENNY BOATS"

Objectives
Students will demonstrate the use of the "Scientific Method."
Students will describe the relationship between volume/weight and density.
Students will describe how modifying variables can impact the outcome of their experiment.

Essential Questions
How does Archimedes Principle explain why boats float?
Why to boats float?
How does a change in volume or weight impact buoyancy?
How can analyzing data from prior attempts improve future results?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A vessel will have positive buoyance when its density is less than the fluid in which it is placed.	The teacher will establish the procedures associated with the activity. Students will test their hypothesis as to the characteristics of a vessel which will carry the maximum load. Students will be provided with multiple opportunities to build and test their solutions. Data from each attempt will be maintained on a sheet. A summary report will be authored by each student which will include their final conclusion. Students will be given a reading assignment to summarize with focuses on the impact of water transportation upon our lives.	Performance on student evaluation Classroom performance
The manipulation of variables can impact the results of an experiment. The ability to transport materials and people has expanded the human experience.		

DESIGN TECHNOLOGY
GRADE 6
UNIT 3: CONSTRUCTION AND TESTING - "HOUSE OF CARDS"

Objectives
Students will explain the difference between the "Dead" and "Live" loads of a structure.
Students will identify the major load bearing components of a structure.
Students will accurately convert measurements in pounds to kilograms.
Students will calculate load bearing efficiency relative to dead versus live load.
Students will efficiently use allocated materials.

Essential Questions
What are the characteristics of a structure which can carry a heavy load?
How do bracing, laminating or adding supports improve the load efficiency of a structure?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Relatively fragile structures can be made extremely strong by adding additional means of support. A solid level foundation is a critical construction characteristic.	Working in groups of two, students will construct a specified structure using two 3" x 5" index cards, i.e. "House of Cards". Given three additional cards and a limited amount of masking tape, students will reinforce the original structure to maximize the load carrying capability of their "house". Finished structures will be destructive tested to determine maximum load. Load data will be collected and analyzed to determine the characteristics which will produce both the strongest and most load efficient structure. Students will be provided with five iterations of the build/destruct process. Students will be given a reading assignment to summarize with focuses on the impact of skyscrapers upon our lives.	Performance on student evaluation Classroom performance

DESIGN TECHNOLOGY
GRADE 6
UNIT 4: CODING - "PRO-BOT Vehicle"

Objectives
Students will work in cooperative groups to write code to program PRO-BOT vehicles.
Students will demonstrate basic coding skills associated with Terrapin LOGO programming.
Students will demonstrate the use the Systems Model to control their Bot.

Essential Questions
How does computer code enable humans to control robots?
How essential is proper syntax to the generation of code?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The knowledge of proper coding techniques will enable students to cause robots to perform complex tasks. The ability to accurately measure the required path of the robot using scale metric scale is essential to successful completion of the assignment.	Teacher led lectures will introduce student to the process of writing code using Terrapin LOGO software to write code to control PRO-BOT robots. Upon the establishment of basic coding skills students will be assigned a list of tasks which their robots are expected to perform. Using the Systems Model (input, process, output, and feedback) students will be expected to troubleshoot bot control issues. Students will be given a reading assignment to summarize with focuses on the impacts automation upon our lives.	Performance on student evaluation Classroom performance

DESIGN TECHNOLOGY
GRADE 6

UNIT 5: RESTRAINT SYSTEMS AND CRUSH ZONES - "Eggstronaut"

Objectives
Students will explain Newton's Laws of Motion and Energy Conservation
Students will work in a cooperative group to complete a complex task.
Students will gather data while field testing their safety devices.
Students will calculate the maximum height to which their "space capsule" flew by using trigonometry or a stop watch and arithmetic formula.

Essential Questions
What are the characteristics of a structure which protects a passenger in the event of a high impact crash?
How do restraint systems work to protect passengers in a vehicle?
How do crush zones save passengers from injury?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Seatbelts have the capacity to save lives when used properly. Crush zones are used to dissipate energy during a crash.	Working in groups of two, students will construct a capsule which will be launched on the top of a water rocket. Capsules will carry a payload of a raw egg. Students may be given multiple attempts to successfully launch and recover an intact payload. A minimum height of flight requirement will be established. Recycled materials will be used to restrain and reduce the effects of impact. Students will be given a reading assignment to summarize with focuses on the impacts space travel upon our lives.	Performance on student evaluation Classroom performance

DESIGN TECHNOLOGY
GRADE 6
PERFORMANCE RUBRIC

CATEGORY	4	3	2	1
Plan	Plan is neat with clear measurements and labeling for all components.	Plan is neat with clear measurements and labeling for most components.	Plan provides clear measurements and labeling for most components.	Plan does not show measurements clearly or is otherwise inadequately labeled.
Function	Project functions extraordinarily well, holding up under atypical stresses.	Project functions well, holding up under typical stresses.	Project functions pretty well, but deteriorates under typical stresses.	Fatal flaws in function with complete failure under typical stresses.
Construction – Materials	Appropriate materials were selected and creatively modified in ways that made them even better.	Appropriate materials were selected and there was an attempt at creative modification to make them even better.	Appropriate materials were selected.	Inappropriate materials were selected and contributed to a product that performed poorly.
Construction – Care Taken	Great care taken in construction process so that the project is neat, attractive and follows plans accurately.	Construction was careful and accurate for the most part, but 1-2 details could have been refined for a more attractive product.	Construction accurately followed the plans, but 3-4 details could have been refined for a more attractive product.	Construction appears careless or haphazard. Many details need refinement for a strong or attractive product.
Journal/Log – Content	Journal provides a complete record of planning, construction, testing, modifications, reasons for modifications, and some reflection about the strategies used and the results.	Journal provides a complete record of planning, construction, testing, modifications, and reasons for modifications.	Journal provides quite a bit of detail about planning, construction, testing, modifications, and reasons for modifications.	Journal provides very little detail about several aspects of the planning, construction, and testing process.
Team Work	The workload is divided and shared equally by all team members.	The workload is divided and shared fairly by all team members, though workloads may vary from person to person.	The workload was divided, but one person in the group is viewed as not doing his/her fair share of the work.	The workload was not divided OR several people in the group are viewed as not doing their fair share of the work.

DESIGN TECHNOLOGY
GRADE 6

RESOURCES

Gram and pound scales
Calculators
White Wing Glider Competition Kits
Stop watches
DVD: Understanding Flight, Discovery Education, Inc.
DVD: Buoyancy, Discovery Education, Inc.
DVD: October Sky, Universal Pictures, Inc. (Edited for family viewing)

PACING GUIDE

Unit	Days 1-10	Days 11-20	Days 21-30
Unit 1: Heavier than Air Craft	XXXXXX		
Unit 2: Buoyancy	XXXX	XXX	
Unit 3: Construction and Testing		XXXXXXX	
Unit 4: Coding			XXXXX
Unit 5: Restraint Systems and Crush Zones			XXXXX

MULTIMEDIA
GRADE 7

Seventh grade students participate in the Multi-Media course as part of their Unified Arts experience. Students attend lab sessions for one trimester of the school year on an alternating day basis for approximately 30 contact days. The course focuses on the use of digital photo and video editing. The first portion of the rotation is dedicated to capturing and editing images taken with a digital camera. Students are introduced to the major photo editing tools associated with Adobe Photoshop. Students are introduced to basic video editing with a project which requires them to produce a music video using till clips and a song of their choosing. Each student will sequence photos which represent the visual imagery of lyrics and include a title, transitions and credits. The balance of the course focuses on the authoring of a short story based upon the theme "Good Advice". Students work in small groups to complete tasks including storyboards, character development, script writing, video image capture, and editing of a their chosen of video topic using Adobe Premier. The course require students author a term paper based upon an interview of a senior member of their family or family friend to assess how much technology has changed in during the past generations.

MULTIMEDIA
GRADE 7
UNIT 1: Photoshop

Objectives
Students will master the use of Photoshop's select tools.
Students will use Photoshop's "layer" facility to construct complex digital images.
Students will exhibit "close reading" skills to follow a series of complex photo editing instructions.

Essential Questions
How and where can digital images be stored and what file formats are available.
How are clips/photos sequenced in a video?
How is a soundtrack added to a video?
How can clips be lengthened or cropped in a video?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Digital images and soundtracks will be stored in an appropriate location.	Students will be provided with lectures and demonstrations of how to store still and music files. Video assembly and editing techniques using Adobe Premier will be demonstrated .	Performance on student evaluation Classroom performance
Assembly of images and music files in to video.		
Basic editing skills to sequence images to the lyrics. Inclusion of title, transitions and credit.		

MULTIMEDIA
GRADE 7

UNIT 2: MUSIC VIDEO

Objectives
Students will write a script based upon an assigned theme.
Students will create a visual representation of major camera shots and movements in storyboard form for their story.
Students will capture video images of their story.
Students will edit the shots into a comprehensive movie which includes: titles, video, audio and credit.

Essential Questions
What are attributes of a quality video project?
How are picture and music files captured and stored for use in a video?
What is the process of editing a movie to a final product?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Digital images and soundtracks will be stored in an appropriate location.	Students will be provided with lectures and demonstrations of Adobe Premier. Detailed instruction packets will guide students to the process of digital video editing.	Performance on student evaluation Classroom performance
Assembly of images and music files in to video. Basic editing skills to sequence images to the lyrics. Inclusion of title, transitions and credit.		

MULTIMEDIA
GRADE 7

UNIT 3: VIDEO PRODUCTION

Objectives
Students will write a script based upon the assigned theme.
Students will create a visual representation of major camera shots and movements in storyboard form for their story.
Students will capture video images of their story.
Students will edit the shots into a comprehensive movie which includes: titles, video, audio and credit.

Essential Questions
What is the process of transforming an idea for a story into a finished video?
What are attributes of a quality video project?
How is a video camera is properly setup and operated?
What is the process of capturing video footage?
How is video uploaded to the PC for editing?
What is the process of editing a movie to a final product?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The process of taking high quality video images requires knowledge, skills and planning. Camera angles, storylines/plots, and music, are all tools used by the videographer to evoke the audience's senses and emotions.	Working in groups of up to three, students choose a topic for a short video which relates to the theme "Good Advice". All projects will require that teams develop a storyboard, complete character profiles, write a script and gather necessary props prior to production. Using equipment available in the video lab, students will capture their video images and then edit their scenes on the PC to product finished movies. In addition to video footage, movies may include titles, still photos, animations, voiceovers, background music, and credits. Finished movies may be shared with peers during the final class of the trimester.	Performance on student evaluation Classroom performance

MULTIMEDIA
GRADE 7

STORYBOARD RUBRIC

CATEGORY	4	3	2	1
Clarity and Neatness	Storyboard is easy to read and all elements are so clearly written, labeled, or drawn that another student could create the presentation if necessary.	Storyboard is easy to read and most elements are clearly written, labeled, or drawn. Another person might be able to create the presentation after asking one or two questions.	Storyboard is hard to read with rough drawings and labels. It would be hard for another person to create this presentation without asking lots of questions.	Storyboard is hard to read and one cannot tell what goes where. It would be impossible for another person to create this presentation without asking lots of questions.
Use of Time	Used time well during each class period (as shown by observation by teacher, and documentation of progress in journal) with no adult reminders.	Used time well during most class periods (as shown by observation by teacher, and documentation of progress in journal) with no adult reminders.	Used time well (as shown by observation by teacher and documentation of progress in journal), but required adult reminders on one or more occasions to do so.	Used time poorly (as shown by observation by teacher and/or documentation of progress in journal) in spite of several adult reminders to do so.
Cooperation	Worked cooperatively with partner all the time with no need for adult intervention.	Worked cooperatively with partner most of time but had a few problems that the team resolved themselves.	Worked cooperatively with partner most of the time, but had one problem that required adult intervention.	Worked cooperatively with partners some of the time, but had several problems that required adult intervention.
Spelling & Grammar	No spelling or grammatical mistakes on a storyboard with lots of text.	No spelling or grammatical mistakes on a storyboard with little text.	One spelling or grammatical error on the storyboard.	Several spelling and/or grammatical errors on the storyboard.
Content	All content is in the students' own words and is accurate.	Almost all content is in the students' own words and is accurate.	At least half of the content is in the students' own words and is accurate.	Less than half of the content is in the students' own words and/or is accurate.
Required Elements	Storyboard included all required elements as well as a few additional elements.	Storyboard included all required elements and one additional element.	Storyboard included all required elements.	One or more required elements were missing from the storyboard.

MULTIMEDIA
GRADE 7

MULTIMEDIA RUBRIC

CATEGORY	4	3	2	1
Overall Presentation	Makes excellent use of font, color, graphics, effects, etc. to enhance the presentation.	Makes good use of font, color, graphics, effects, etc. to enhance to presentation.	Makes use of font, color, graphics, effects, etc. but occasionally these detract from the presentation content.	Use of font, color, graphics, effects etc. but these often distract from the presentation content.
Rough Draft	Rough draft brought on due date. Student shares with peer and extensively edits based on peer feedback.	Rough draft brought on due date. Student shares with peer and peer makes edits.	Provides feedback and/or edits for peer, but own rough draft was not ready for editing.	Rough draft not ready for editing and did not participate in reviewing draft of peer.
Requirements	All requirements are met and exceeded.	All requirements are met.	One requirement was not completely met.	More than one requirement was not completely met.
Content	Covers topic in-depth with details and examples. Subject knowledge is excellent.	Includes essential knowledge about the topic. Subject knowledge appears to be good.	Includes essential information about the topic but there are 1-2 factual errors.	Content is minimal OR there are several factual errors.
Organization	Content is well organized using headings or bulleted lists to group related material.	Uses headings or bulleted lists to organize, but the overall organization of topics appears flawed.	Content is logically organized for the most part.	There was no clear or logical organizational structure, just lots of facts.
Originality	Product shows a large amount of original thought. Ideas are creative and inventive.	Product shows some original thought. Work shows new ideas and insights.	Uses other people's ideas (giving them credit), but there is little evidence of original thinking.	Uses other people's ideas, but does not give them credit.
Workload	The workload is divided and shared equally by all team members.	The workload is divided and shared fairly by all team members, though workloads may vary from person to person.	The workload was divided, but one person in the group is viewed as not doing his/her fair share of the work.	The workload was not divided OR several people in the group are viewed as not doing their fair share of the work.

MULTIMEDIA
GRADE 7

PRE-PRODUCTION RUBRIC

CATEGORY	4	3	2	1
Teamwork	Students meet and discuss regularly. All students contribute to the discussion and all are listened to respectfully. All team members contribute a fair share of the work.	Students meet and discuss regularly. Most students contribute to the discussion and are listened to respectfully. All team members contribute a fair share of the work.	A couple of team meetings are held. Most students contribute to the discussion and are listened to respectfully. All team members contribute a fair share of the work.	Meetings are not held AND/OR some team members do not contribute a fair share of the work.
Concept	Team has a clear picture of what they are trying to achieve. Each member can describe what they are trying to do and generally how his/her work will contribute to the final product.	Team has a fairly clear picture of what they are trying to achieve. Each member can describe what they are trying to do overall but has trouble describing how his/her work will contribute to the final product.	Team has brainstormed their concept, but no clear focus has emerged for the team. Team members may describe the goals/final product differently.	Team has spent little effort on brainstorming and refining a concept. Team members are unclear on the goals and how their contributions will help them reach the goal.
Storyboard	Storyboard is complete with sketches for each scene, detailed notes on titles, transitions, special effects, sound, etc. Storyboard reflects outstanding planning and organization for the visuals in the video.	Storyboard is relatively complete with sketches for most scenes, and notes on titles, transitions, special effects, sound, etc. Storyboard reflects effective planning and organization for the visuals in the video.	Storyboard has glaring omissions in scene planning. There are some sketches, and notes on titles, transitions, special effects, sound, etc. Storyboard reflects attempts at planning and organization for the visuals in the video.	Storyboard is not done or is so incomplete that it could not be used even as a general guide. Storyboard reflects very little planning of the visuals.
Script	Script is complete and it is clear what each actor will say and do. Entries and exits are scripted as are important movements. Script is quite professional.	Script is mostly complete. It is clear what each actor will say and do. Script is shows planning.	Script has a few major flaws. It is not always clear what the actors are to say and do. Script shows an attempt at planning, but seems incomplete.	There is no script. Actors are expected to invent what they say and do as they go along.
Equipment Preparation	All necessary equipment/supplies are located and scheduled well in advance. All equipment (sound, light, video) is checked the day before the shoot to ensure it is operational. A backup plan is developed to cover possible problems with power, light, etc.	All necessary equipment/supplies are located and scheduled a few days in advance. All equipment (sound, light, video) are checked the day before the shoot to ensure they are operational. A backup plan is developed.	On the day of the shoot, all necessary equipment/supplies are located and checked to ensure they are operational. There may or may not be a backup plan.	Needed supplies/equipment are missing OR were not checked before the shoot.

MULTIMEDIA
GRADE 7

RESOURCES

Adobe® Photoshop® Elements
Adobe® Premier® Elements
Misc. video capture equipment

PACING GUIDE

Unit	Days 1-10	Days 11-20	Days 21-30
Unit 1: Digital Photography	XXXXXXX		
Unit 2: Music Video	XXX	XXXXXX	
Unit 3: Video Production			
a) Preproduction		XXXX	XXXXX
b) Production			XX
c) Post Production			XXX

STATE OF CONNECTICUT TECHNOLOGY EDUCATION STANDARDS

NATURE OF TECHNOLOGY (GRADES 6-8)

NT.01	**Recognize the nature, characteristics and scope of technology.**
NT.01.01	Explain that new products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.
NT.01.02	Explain that technology is closely aligned to creativity, which has resulted in innovation.
NT.01.03	Describe how new technologies (products and systems) are developed to solve problems.
NT.01.04	Recognize and explain that creativity is the basis for the development of products and systems.
NT.01.05	Explain that technology is a powerful force that improves human productivity.
NT.01.06	Recognize and explain that technology is a process for transforming raw materials into useful goods and services.
NT.01.07	Explain that technology is evident in every culture, regardless of its level of sophistication or stage of development.
NT.01.08	Recognize and explain that technology involves inventing new things and modifying the old ones to make them more efficient.
NT.01.09	Describe technology as a process for transforming raw materials into useful goods and services.
NT.01.010	Explain that new products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.
NT.01.011	Explain that technology is closely linked to creativity, which has resulted in innovation.
NT.01.012	Explain that technological innovation is driven by the profit motive.
NT.01.013	Explain that technology creates new economic opportunities and social benefits and, at the same time, produces new social problems.
NT.01.014	Describe how and why people use technology to modify their natural environment and the impact of those modifications.
NT.01.015	Explain that technology incorporates human knowledge into physical hardware that will eventually respond to some human need or desire.
NT.01.016	Explain that new products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.
NT.01.017	Explain that corporations can often create demand for a product by bringing it onto the market and advertising it.
NT.02	**Demonstrate an understanding of the core concepts of technology.**
NT.02.01	Explain a technological system by identifying its parts (inputs, processes, output and feedback)
NT.02.02	Differentiate between the systems found in nature vs. human made technological systems.
NT.02.03	Show evidence of how parts relate to each other through systems thinking.
NT.02.04	Differentiate between an open and closed system.

NT.02.05 Explain the benefits and consequences of and technological innovation.
NT.02.06 Explain that a trade-off is a decision process recognizing the need for careful compromises among competing factors.
NT.02.07 Define the parameters of a product.
NT.02.08 Define the processes used to complete a system.
NT.02.09 Evaluate the importance of maintenance on a system ensure proper functioning, extending life and upgrading capability.

NT.03 Define and explain the relationships among technologies and the connections between technology and other fields of study.

NT.03.01 Illustrate how technology systems often interact with each other.
NT.03.02 Demonstrate how technological systems are combined to create more complex systems.
NT.03.03 Implement knowledge from other fields of study and show effect on the development of technological products and systems.
NT.03.04 Describe how technological ideas are sometimes protected through the process of patenting.

IMPACT OF TECHNOLOGY (GRADES 6-8)

IT.01 Develop abilities to assess the impacts of products and systems.

IT.01.01 Design and use instruments to gather data.
IT.01.02 Identify trends and monitor potential consequences of technological development.
IT.01.03 Interpret and evaluate the accuracy of the information obtained and determine if it is useful.
IT.01.04 Determine if the human use of a product or system creates positive or negative results.
IT.01.05 Use data collected to analyze and interpret trends in order to identify the positive or negative effects of technology.
IT.01.06 Interpret and evaluate the accuracy of the information obtained and determine if it is useful.
IT.01.07 Analyze important ideas and messages in informational text to determine the impact of a technology product or system.

IT.02 Recognize and explain the cultural, social, economic, and political effects of technology.

IT.02.01 Assess the impact of technology as it affects humans.
IT.02.02 Examine how technology use changes our environment.
IT.02.03 Describe how the use of technology poses ethical problems.
IT.02.04 Describe achievements of people from different backgrounds and abilities who have made various contributions to technology and science.
IT.02.05 Evaluate the historical impact of various technological and scientific contributions.
IT.02.06 Cite instances where technology has caused cultural, social, economic, and political changes.

IT.03	**Explain the effects of technology on the environment.**
IT.03.01	Assess the impact of the management of technological waste on society.
IT.03.02	Investigate how the decision to use technology puts environmental and economic concerns in direct competition with each other.
IT.03.03	Recognize and explain that technological changes and advances have consequences for the immediate environment.
IT.03.04	Evaluate local, regional or global issues surrounding technology.
IT.03.05	Defend how technologies can be used to repair damage caused by natural disasters.
IT.03.06	Describe how technologies can be used to break down wastes that result from the use of various products and systems.

DESIGN AND DEVELOPMENT: ENGINEERING (GRADES 6-8)

DD.01	**Explore the major enterprises of the designed world.**
DD.01.01	Evaluate the major enterprises of the designed world, in the fields of communications, construction, manufacturing and transportation.
DD.01.02	Incorporate science concepts and mathematic processes applied through the use of technology.
DD.01.03	The positive and negative aspects of a design.
DD.01.04	Plan multiple design solutions to solve a problem.
DD.01.05	Explain why a design process leads to useful products and processes.
DD.01.06	Critique designs and products created to solve a problem.
DD.01.07	Explain that requirements for a design are made up of criteria and constraints.
DD.02	**Explore the engineering design.**
DD.02.01	Demonstrate that evaluating, modeling, modifying and testing can be used to transform ideas into practical solutions.
DD.02.02	Gather information to gain background knowledge related to a problem.
DD.02.03	Construct a timeline to solve a problem.
DD.02.04	Select and use appropriate, materials, tools and machines.
DD.02.05	Construct tables, charts, databases, spreadsheets, and graphs to display data.
DD.02.06	Relate the design process beyond the classroom.
DD.02.07	Create various graphic representations or drawing of the design solution.
DD.02.12	Evaluate the effectiveness of a model and recommend necessary changes.

STATE OF CONNECTICUT TECHNOLOGY EDUCATION STANDARDS

DD.03	**Explore the four human productive areas of technology: communications, construction, manufacturing, transportation and other related fields.**
DD.03.01	Explain that information and communication systems allow information to be transferred from human to human, human to machine, and machine to human.
DD.03.02	Explain that communication systems are made up of a source, encoder, transmitter, receiver, decoder, and destination.
DD.03.03	Explain that the use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.
DD.03.04	Identify and describe types of land, water air and space transportation systems.
DD.03.05	Investigate and describe the functioning of structural, propulsion, suspension, and guidance control vehicular subsystems.
DD.03.06	Diagram and demonstrate the processes used for operating an efficient transportation system.
DD.03.07	Explain how secondary manufacturing processes are used to change the form of materials.
DD.03.08	Explain that manufactured goods are classified as durable and non-durable.
DD.03.09	Explain the primary manufacturing processes used to extract material.
DD.03.10	Identify the factors used to select the designs for structures based on building laws and codes, style, convenience, cost climate, and function.
DD.03.11	Explain that buildings contain a variety of subsystems.

WOODWORKING
GRADES 9-12

This course is designed to teach students the safe and proper use of woodworking machines and tools while processing rough lumber from a raw material into a finished project/product. Students will learn about project design and draw basic plans for their projects. This laboratory class will be taught with a hands-on approach while emphasizing shop safety, at all times. This is a semester course offered to students in grades 9-12.

Credit: 0.5

WOODWORKING
GRADES 9-12

UNIT 1: MEASUREMENT AND LAYOUT

Objectives
Students will measure accurately to a 16th of an inch.
Students will properly use layout tools to measure and mark their workpieces before processing them.

Essential Questions
Why is it important to measure accurately when constructing a woodworking project/product?
How do you measure accurately to a 16th of an inch?
What does tolerance mean as related to measurement?
How accurately can you measure with the naked eye?
What is layout work and how is it performed?
What are layout tools and how are they used?
What is meant by the expression measure twice and cut once?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Accurate measurement is important when constructing something.	Each student will construct a variety of projects demonstrating his or her ability to accurately layout a workpiece. Each student will take a measurement quiz to assess his/her ability to measure accurately within a 16th of an inch. (The teacher will work with students having difficulty until they achieve a minimum score of 80%). Each student with construct woodworking projects that will demonstrate his/her level of ability assessed by a teacher rubric.	Performance on student evaluations Student performance in the wood lab on a day to day basis Teacher assessment of student ability based on a rubric
If you can count to 16 you can measure to a 16th of an inch.		
Tolerance is the amount of error that is acceptable when measuring.		
When you measure and a workpiece you are doing layout work.		
Layout tools are measuring and marking tools.		
You should always double-check your measurements before processing your work piece.		

WOODWORKING
GRADES 9-12

UNIT 2: INTRODUCTION TO WOOD AND ITS PROPERTIES

Objectives

Students will explain what hardwood and softwood means.
Students will identify various types of hardwood trees and softwood trees.
Students will identify why some woods are more desirable than others.
Students will explain why certain woods are chosen to produce various wood products.
Students will identify various woods that are used in the school shop.
Students will demonstrate same material handling procedures
Students will consider natural characteristics when choosing wood and laying it out.
Students will understand the correlation between grains affects material strength.

Essential Questions

What is the difference between hardwood trees and softwood trees?
What properties of a particular wood make it desirable for use in various products?
Where do various types of woods come from and what trees are native to New England?
What is the proper way to handle raw materials?
How does wood grain affect the strength of a board.

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Trees are classified in two categories: hardwoods and softwoods.	Students will choose a wood for their individual project, based on its properties and cost, and they will be able to identify it from the other woods in the stockroom.	Teacher evaluation of student performance in the lab as they select their materials and construct their projects.
The properties of a particular wood determine its usefulness.		
The availability of a particular wood determines its price.		

WOODWORKING
GRADES 9-12

UNIT 3: SAFETY

Objectives

Students will define the safety concerns in a woods lab including the safe disposal of chemicals.
Students will discuss personal responsibility for individual and group safety.
Students will indicate the locations of emergency stop buttons, exits, exit routes, eyewash station, first aid kit, and firefighting equipment.
Students will follow the proper safety rules for using hand tools and power equipment and wear the proper clothing.

Essential Questions

What are the dangers in performing construction activities in the shop?
How can these dangers be reduced or eliminated?
Upon which trade or job position does responsibility lie for the safe performance, completion and/or quality of a given construction operation?
How can what I learned in school about safety help me in life?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Safety is a personal and a group responsibility. Construction is an occupation whose many dangers can be minimized through forethought, planning, and an appropriate working attitude.	Discuss classroom procedures for classroom emergencies, fire drills for fire and student injuries. Students will pass a prescribed safety instruction quiz before using the lab, tools, or equipment. Instructor will continually monitor student compliance of safety rules.	Appropriate performance on student evaluation and/or classroom participation. Use of the Technology Education Department PLC safety unit to prepare and monitor student safety preparation and practices.

WOODWORKING
GRADES 9-12

UNIT 4: JOINERY

Objectives

Students will identify basic wood joints such as butt, dado, miter, lap, etc.
Students will choose appropriate joinery for basic wood projects.
Students will identify when to use glue and/or mechanical fasteners for added strength.
Students will properly glue up a project and/or install mechanical fasteners.
Students will identify which clamps to use for certain applications.
Students will properly install clamping devices to secure the pieces until the glue dries.
Students will demonstrate the proper use a variety of assembly tools, fasteners, and adhesives.

Essential Questions

How can wood joints improve the strength of a project/product?
What kind of wood joint should be used in various applications?
How can wood joinery eliminate the need for mechanical fasteners?
How can wood joints make assembly easier?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Wood joinery improves the strength and aesthetics of a wooden project/product.	Students will employ a variety of wood joints in their projects and assemble pieces using glue and/or mechanical fasteners, employing the appropriate clamping devices.	Teacher evaluation of student performance on his/her individual problem project.
Certain joints are stronger than others.		
Wood joinery can eliminate the need for mechanical fasteners.		
Wood joinery can help make for ease of assembly.		

WOODWORKING
GRADES 9-12

UNIT 5: DESIGN AND PLANNING

Objectives

Students will use an engineering approach to problem solving called the technology systems model.
Students will define the phrase “form follows function”.
Students will explain how proportion and aesthetics relate to design.
Students will sketch a detailed set of assembly and detail drawing before starting construction.
Students will read and follow simple drafting blueprints in order to complete their project.
Students will make a bill of materials and calculate the cost in both board and lineal feet.

Essential Questions

What is the engineering process for solving problems?
Why do people fail to reach their goals in life?
Why is research an important step in reaching a desired goal?
Why is a plan referred to as a roadmap to success or failure?
What element of design should be considered when planning your project?
Why is drafting a universal language?
Why are three views needed to fully describe a three-dimensional object on paper?
Why do most objects need to be scaled when drawing them?
Why is it important to consider materials costs when designing a project/product?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
You can solve any problem in life by following an engineering approach to problem-solving, including the following steps: input, process, output, and feedback.	Students will research a woodworking problem project of his or her choice and then make a detailed plan of it utilizing the basic principles of drafting and orthographic projection and then compile a bill of materials to compute the cost before starting construction.	Teacher will use a rubric to assess student performance in designing and drawing the plans and bill of materials.
There are only two reasons for failing to reach your goal. One is that your goal is unrealistic and the other is you quit.		
Knowledge is the key to success and therefore research is essential to solving any problem.		
Making a detailed plan is the most important step in solving any problem.		
When designing an object form follows function.		
Drafting is a universal language.		
Three views are usually needed to draw a three-dimensional object on a two dimensional piece of paper.		
When drawing plans the object must be scaled to fit the paper.		
Before starting construction each student must calculate a bill of materials.		

WOODWORKING
GRADES 9-12

UNIT 6: SEPARATING OPERATIONS

Objectives

Students will list the machines and tools that perform a separation process.
Students will demonstrate the safe operation of separating tools and power equipment alloying for kerf.
Students will explain the difference between the separation and shaping process.

Essential Questions

What is material separation?
What machines and tools in the school shop are used to perform the separation process?
What is the proper procedure for using separation machines and tools?
What is meant by the term "machine setup" and what is the proper setup for performing specific procedures on separation machines and tools?
What special safety precautions should be followed when using separation machines or tools?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A separation process is used to produce desired work pieces.	Each student will construct a variety of objects that will demonstrate his/her ability to set up, and perform the safe operation of a variety of machines and tools in the school shop that perform separation processes.	The teacher will use a rubric to assess student performance in performing separation processes on their individual projects.
Saws, chisels, and shears, etc. are common tools used in the separation process.		
Specific safety measures must always be followed for each machine or tool that performs a separation process.		

WOODWORKING
GRADES 9-12

UNIT 7: SHAPING OPERATIONS

Objectives

Students will list the machines and tools in the school shop that perform a shaping operation.
Students will demonstrate the safe operation of shaping tools and equipment.
Students will demonstrate the proper setup for specific shaping operations.
Students will identify specific safety rules for each shaping machine or tool in the shop.
Students will differentiate various types of abrasives, their grading system, and their effect on grain direction.

Essential Questions

What is a shaping operation?
Which machines and tools in the school shop perform a shaping operation and what types of shapes do they produce?
What are the proper procedures for using shaping machines and tools?
What is the proper setup for specific shaping operations?
What special safety precautions should you follow when using specific shaping machines or tools?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A shaping operation has been performed when a machine or tool is used to modify the surface or edge of a work piece without separating it into multiple workpieces.	Each student will construct a variety of projects that will demonstrate his/her ability in setting up and performing the safe performance of the shaping process.	The teacher will use a rubric to assess student performance in performing shaping operations on their individual projects.
Chisels, planes, routers, drills, and sanders, etc. are common tools used in shaping processes.		
Specific safety measures must always be followed for each machine or tool for performing the shaping process.		

WOODWORKING
GRADES 9-12

UNIT 8: FINISHING OPERATIONS

Objectives

Students will differentiate between a surface finish and a penetrating finish.
Students will explain the reason for surface preparation before and during the application of wood finish.
Students will relate the advantages and disadvantages of different types of wood finishes.
Students will explain the importance of safety in the finishing room.
Students will explain the need for proper lighting and ventilation while performing finishing operations.
Students will explain the need for applying a wood finish.
Students will demonstrate the proper application of various wood finishes.

Essential Questions

Why does wood usually need to be finished?
What types of finishes do we have in the school shop?
How do you properly apply a wood finish?
What safety procedures should be followed when applying a wood finish?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Proper surface preparation is essential before applying wood finishes.	The student will perform finishing operations on his/her completed woodworking project.	The teacher will evaluate the quality of the project finish as a part of the completed project evaluation.
Specific safety procedures must be followed when applying wood finishing operations.		
Wood finishes protect the surface of the wood while adding aesthetic value.		

WOODWORKING
GRADES 9-12

PROJECT PLAN RUBRIC

	5 Exceptional	4 Proficient	3 Minimal	2 Inadequate	1	Student Evaluation	Teacher Evaluation
Communicate in Standard English	Student has completed an analysis of his/her completed woods project, and fully understands what could be done to improve it.	Student has completed an analysis of his/her completed woods project, and has a good understanding of what could be done to improve it.	Student has partially completed an analysis of his/her wood project, and/or has a partial understanding o what could be done to improve it.	Students has either made a poor attempt at completing an analysis of his/her woods project, or has a poor understanding of what could be done to improve it.	Project analysis not done.		
Read and understand a variety of materials	Student has searched the internet and has recorded four websites on the worksheet as benchmark sources to help plan their individual woodworking project.	Student has searched the internet and has recorded three websites on the worksheet as benchmark sources to help plan their individual woodworking project.	Student has searched the internet, and has recorded only two websites, or has done the research after his/her woodworking project plans were completed.	Student has searched the internet, but has recorded only one website as a benchmark source to help plan their individual woodworking project.	Research not done.		
Evaluate information to interpret events and make informed responses	Student has evaluated his/her woodworking plans and project, and has accurately assessed his/her own performance grade within 10 points of teacher evaluation.	Student has evaluated his/her woodworking plans, and project, and has assessed his/her own performance within 11-20 points of teacher evaluation.	Student has evaluated his/her woodworking plans and project, and has assessed his/her own performance within 21-30 points of teacher evaluation.	Student has evaluated his/her woodworking plans, and project, and has assessed his/her own performance within 31-40 points of teacher evaluation.	Evaluation not done.		
Apply scientific principles to solve problems	Student fully understands and utilizes accepted drafting principles to solve design problems, and has produced exceptional working drawings for his/her problem project.	Student has a good understanding of accepted drafting principles, and used them to make good working drawings for his/her woodworking problem project.	Student demonstrates a partial understanding of accepted drafting principles, and partially uses them to make working drawings for his/her woodworking problem project.	Student demonstrates little or no understanding of accepted drafting principles, and has great difficulty drawing working plans for his/her woodworking	Plans not done.		
Utilize technology to organize and solve problems	Student shows exceptional skills in utilizing all woodworking equipment and technologies and has produced an exceptional project.	Student shows good skills in utilizing all woodworking equipment and technologies, and has produced a good project.	Student shows partial skills in utilizing all woodworking equipment and technologies, and has produced a fair project.	Student shows little skill utilizing woodworking equipment and technologies, and has produced a poor project.	Student has not produced any project.		
				Total Score			
				Score/5=Grade %			

WOODWORKING
GRADES 9-12

RESOURCES

Modern Cabinetmaking, Umstattd, W.D. The Goodheart-Wilcox Co., Inc., South Holland, Illinois.
Safety handout and worksheets, Safety lesson, Safety video, Safety test

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: Measurement and Layout	X	
Unit 2: Introduction: Wood and Their Properties	X	
Unit 3: Safety	X	
Unit 4: Joinery	X	
Unit 5: Design and Planning	X	
Unit 6: Separating Operations	X	
Unit 7: Shaping Operations	X	
Unit 8: Finishing Operations		X

ADVANCED WOODWORKING
GRADES 10-12

This course is designed to further the student's abilities and skill levels in using wood as an artistic and functional medium. Major emphasis will be placed on design and wood layout along with the proper use of woodworking tools and machinery and shop safety. Each student will be given the opportunity to further the development of his or her woodworking abilities by means of a hands-on approach to creating individualized custom projects. Students will be expected to demonstrate independent thinking to foster their problem-solving skills. This course is open to students in grades 10, 11 and 12.

Prerequisite: Woodworking

Credit: 1.0

ADVANCED WOODWORKING
GRADES 10-12
UNIT 1: INTRODUCTION: WOOD AS A BUILDING MATERIAL

Objectives

Students will explain how wood as a building material affected man's technological evolution.
Students will define what is meant by "hardwood" and "softwood".
Students will list various wood products with use-specific properties.
Students will define "manufactured wood product" and list examples.
Students will explain what is meant by the term "renewable resource".
Students will give examples how wood affects today's economy.
Students will appraise the impact that wood manufacturing has on their future aspirations; both career based and/or as an educated consumer.

Essential Questions

Why was wood used as the first construction material?
What properties do some woods have that allows them to resist decay?
What are the main differences between hardwoods and softwoods?
What effect does manufactured wood products have on cabinetmaking and construction?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Wood was the first building material used on a large scale as a result of its abundance, light weight, availability, and formability.	Students will be shown examples of various species and wood products, and will be assessed on their ability to properly identify them and give suggestions for appropriate uses of that product.	Students will determine the type of wood to be used their project based on its properties and cost.
Wood can be classified into two major categories, hardwoods and softwoods.		
Wood properties such as density, hardness, toughness and rot-resistance can determine its usefulness.		
Wood products can be naturally harvested, or manufactured from wood by-products.		
The production and distribution of wood materials are important international industries with global implications.		

ADVANCED WOODWORKING
GRADES 10-12
UNIT 2: SAFETY

Objectives

Students will define some of the safety concerns in a construction lab.
Students will discuss personal responsibility for individual and group safety.
Students will indicate the locations of emergency stop buttons, exits, exit routes, eyewash station, first aid kit, and firefighting equipment.
Students will be able to describe and demonstrate the procedures related to the workplace and job site safety including safety equipment, machine safety, and material handling.
Student will demonstrate the safe and appropriate use of various types of hand and power tools and machinery used in the wood lab.
Students will follow the appropriate safety rules, wear appropriate clothing, and demonstrate the proper handling and disposal of chemicals.

Essential Questions

What are the dangers in performing construction activities in the shop?
How can these dangers be reduced or eliminated?
Upon which trade or job position does responsibility lie for the safe performance, completion or quality of a given construction operation?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Safety is a personal and a group responsibility. Construction is an occupation whose many dangers can be minimized with forethought and an appropriate attitude.	Practice emergency drills for fire and injury. Students will pass a prescribed safety instruction unit before using the lab, tools, or equipment. Instructor monitors continuously, and students practice mutual feedback for compliance with safety procedures.	Appropriate performance on student evaluation and/or classroom participation. Use of the Technology Education Department PLC safety unit to prepare and monitor student safety preparation and practice.

ADVANCED WOODWORKING
GRADES 10-12
UNIT 3: JOINERY

Objectives

Students will explain how a wood joint affects the quality of a product.
Students will list and explain several commonly used woodworking joints.
Students will explain how certain joints may affect the appearance of a product.
Students will critique the effectiveness of different wood joints.
Students will know how to properly use joining hand tools and power equipment.
Students will list different types of mechanical fasteners and know how to install them.
Students will demonstrate the use of common adhesives and various clamping devices.

Essential Questions

How can a consumer tell at a glance if a piece of furniture is of high quality, average quality, or poor quality?
Should a quality piece of furniture rely on mechanical fasteners or adhesives?
What role do mechanical fasteners play in a product's construction?
How can a properly chosen wood joint affect the appearance and function of a product?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The quality of a product's joinery can determine the quality of the finished product.	Students will create a sample project containing various woodworking joints. During the design, the students will discuss different jointing techniques, and the class will choose appropriate joints. Throughout the construction of the project, the student will demonstrate how to properly layout, cut, and assemble various wood joints.	Appropriate performance on student evaluation and/or classroom participation as evidenced by skill levels and work ethic in the completion of their project.
Higher quality joinery can eliminate the need for mechanical fasteners.		
Appropriate wood joints can improve strength, as well as the aesthetics of a product.		
Many times, specific joints are required for particular situations.		
Proper choice and use of various adhesive and clamping devices aids the woodworker and strengthens joinery.		

ADVANCED WOODWORKING
GRADES 10-12
UNIT 4: DESIGN AND PLANNING

Objectives

Students will define the phrase “form follows function”.
Students will explain the concept of proportion, and how it relates to design.
Students will explain how the application of different species of wood and different types of joints can affect aesthetics.
Students will list the most appropriate views to be included on a plan.
Students will make assembly and detail drawings and calculate the cost of materials before starting construction.
Students will apply mathematic skills to calculate board foot and linear foot material cosst.
Students will utilize a plan and bill of materials to aid in the construction of a product.

Essential Questions

What factors most greatly affect the design of a product?
How can a wood’s color and/or grain improve the beauty of a piece? Detract from it?
How can the materials for a product be efficiently and accurately calculated?
How is a plan drawn and then interpreted to determine material need, cutting order, and procedure?
What is meant by “measure twice, cut once”?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A product must be both functional and aesthetically pleasing; however, form must always follow function.	Students will generate a plan of a project which will be built by each member in the class. Elements of design will be discussed, and then applied to the product’s form. A plan will be generated showing appropriate views, dimensions, and details. Finally, a bill of materials will be generated showing such information as sizes of components, type of wood, board foot calculation, and cost.	Appropriate performance on student evaluation and/or classroom performance.
Proportion is of the utmost importance when determining the dimensions of the product.		
The use of a certain species of wood, or a combination of species can add to the beauty of the piece.		
Stock is sold by the board foot. The woodworker must have a working knowledge of its calculation.		
An appropriate design and bill of materials are important resources throughout the construction of the product.		
Appropriate measurement is an invaluable woodworking skill.		

ADVANCED WOODWORKING
GRADES 10-12
UNIT 5: SEPARATING OPERATIONS

Objectives

Students will list the tools used to perform separating operations.
Students will demonstrate safe operation of hand tools and power equipment.
Students will explain the importance of having high quality and sharp cutting tools.
Students will list and explain basic safety rules for each separating tool or piece of equipment in the shop.
Students will explain the difference between a separating and shaping operation.
Students will cut their pieces accurately to a 16^{th} of an inch allowing for the kerf.

Essential Questions

How does a separating operation differ from a shaping operation?
When using a stationary power tool to perform a separating operation, how high above the guard and/or the cutter should be set?
What impact has carbide had on the safety and effectiveness of cutting tools?
What is meant by "measure twice, cut once"?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Whenever a piece of stock is divided in sections or separate pieces, a separating operation has been performed.	Throughout the class, the students will demonstrate an ability to safely set up, and perform cuts using an assortment of separating tools and equipment. Evidence of task completion will be observed on a daily basis by the instructor, and will be evident at the completion of the project, during its evaluation.	Appropriate performance on student evaluation and/or classroom participation.
Saws, chisels, and shears are common tools used in separation processes.		
Typically, a separating process is used to produce a desired size.		
Safety measure must always be followed when performing separating operations.		

ADVANCED WOODWORKING
GRADES 10-12
UNIT 6: SHAPING OPERATIONS

Objectives

Students will list tools used to perform shaping operations.
Students will demonstrate safe operation of shaping hand tools and power equipment.
Students will explain the importance of having high quality and sharp cutting tools.
Students will list and explain basic safety rules for each shaping tool or piece of equipment in the shop.
Students will explain the difference between a shaping and a separating operation.
Students will differentiate between different types of abrasives and grits for sanding.
Students will explain and demonstrate safe turning principles in producing a finished project/product form a raw material on a wood lathe.

Essential Questions

How does a shaping operation differ from a separating operation?
When using a stationary power tool to perform a shaping operation, how high above the work piece should the guard, and/or the cutter be set?
Which tools are able to apply a decorative edge to a workpiece?
Students understand how the species of the wood determines which shaping processes can be performed on a workpiece?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Whenever a piece of stock needs to have an edge or surface modified without separating the work piece into multiple parts or divided, a shaping operation needs to be performed.	Throughout the class, the students will demonstrate an ability to safely set up, and perform cuts using an assortment of shaping tools and equipment. Evidence of task completion will be observed on a daily basis by the instructor, and will be evident at the completion of the project, during its evaluation.	Appropriate performance on student evaluation and/or classroom participation.
Planes, lathes, routers, drills, mortises, jointers, shapers, and sanders are common tools used in shaping processes.		
Typically, a shaping process is used to modify an edge or a surface to allow for proper adhesion, provide a necessary function to the product, or to improve the aesthetics of the product.		
Safety measures must always be followed when performing shaping operations.		

ADVANCED WOODWORKING
GRADES 10-12
UNIT 7: FINISHING OPERATIONS

Objectives

Students will understand the importance of properly preparing the surface of the wood before applying a finish.
Students will list and explain the steps followed in a typical finishing operation.
Students will differentiate between a surface finish and a penetrating finish.
Students will explain the reason for surface preparation before and during the application of wood finish.
Students will relate the advantages and disadvantages of different types of wood finishes.
Students will explain the importance of safety in the finishing room.
Students will explain the need for proper lighting and ventilation while performing finishing operations.
Students will explain the need for applying a wood finish.
Students will demonstrate proper techniques when applying a wood finish.

Essential Questions

What is the rationale for applying a finish to the wood?
What is meant by "surface preparation"?
Which finish is most widely used on wood furniture?
Why is eye protection so important while applying a chemical finish to a wood product?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
When a piece of stock, or final product, is prepared for and then given a protective and appealing surface treatment, a finishing process is implemented.	The student will perform a finishing operation after the construction of a product is completed. The student will choose an appropriate type of finish based on the use and location of the finished product. Evidence of task completion will be observed by the instructor, and will be evident at the completion of the project, during its evaluation.	Appropriate performance on student evaluation and/or classroom participation in the completion of their project.
Tacking, raising the grain, applying stain, paint, lacquer, shellac, polyurethane, oil, filler, and wax are all considered finishing operations.		
Safety practices must be adhered to while performing finishing operations.		
The finishing operation can "make" or "break" a product's appeal and/or value.		

ADVANCED WOODWORKING
GRADES 10-12
UNIT 8: PROJECT CRITIQUE

Objectives
Students will explain the process through which a product is critiqued.
Students will demonstrate an ability to receive criticism.
Students will list ways in which a critique can foster product development.

Essential Questions
Why should a woodworker look at his/her project with a critical eye?
How will acceptance of criticism help a woodworker improve his craft?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Only through analyzing and questioning results on past projects, can the woodworker truly improve his technique.	The student will meet with the instructor and evaluate his/her finished product, collaboratively. A rubric will be employed to aid in the effective analysis of the finished product, and to serve as a benchmark for future assessment.	Appropriate performance on student evaluation and/or classroom participation.
The mark of an exceptional wood worker is not one who does not make mistakes, but rather one who is able to conceal them well.		
The ability to accept constructive criticism is a lifelong skill required by any member of society.		

ADVANCED WOODWORKING
GRADES 10-12
PROJECT PLANNING CRITERIA / GRADING

Name: _____ Class: _____ Date: _____

	A (95)	B (85)	C (75)	D (65)	F (55)
Plan & Dimensions	All pieces were accounted for, plan was clear and easy to understand, and all dimensions were accurate and listed.	All pieces were accounted for, but plan was confusing and/or not all dimensions were either accurate or listed.	Some pieces may have been omitted from the Bill of Materials, plan was confusing and/or not all dimensions were accurate or listed.	Many pieces were omitted from the Bill of Materials, plan was confusing, and many dimensions were not accurate or listed.	Material list was not attempted.
Board Foot Calculation	Board foot calculations and price were all accurately completed.	Board foot calculations and price were all completed with minor mistakes.	Board foot calculations and price were attempted, but done incorrectly.	Portions of the board foot calculations and price were not attempted.	Board foot calculations and price were not attempted.
Critique/ Suggestions	Suggestion was well thought out. It was a unique idea which would not only improve the form of the project, but also its function.	Suggestion was useful, but was not unique. The suggestion was appropriate, but would not drastically improve the design in any way.	The suggestion showed little thought. It's aim would not be a practical improvement to the existing design.	A suggestion was made, but it would have negatively affected the existing design. Obviously not a lot of though was given to it.	No suggestion was given.

ADVANCED WOODWORKING
GRADES 10-12

RESOURCES

Modern Cabinetmaking, Umstattd, W.D. The Goodheart-Wilcox Co., Inc., South Holland, Illinois.
Safety handout and worksheets, Safety lesson, Safety video, Safety test

PACING GUIDE

Unit	Semester 1	Semester 2
Unit 1: Introduction: Wood and Their Properties	X	
Unit 2: Safety	X	
Unit 3: Joinery	X	
Unit 4: Design and Planning	X	
Unit 5: Separating Operations	X	
Unit 6: Shaping Operations	X	
Unit 7: Finishing Operations		X
Unit 8: Project Critique		X

STATE OF CONNECTICUT TECHNOLOGY EDUCATION STANDARDS

WOOD TECHNOLOGY (GRADES 9-12)

WM.01 **Identify and appraise the impacts wood manufacturing has on their future aspirations; both career based and/or as an educated consumer.**

WM.01.01 Develop career goals and objectives as part of a plan for future career direction.

WM.01.02 Develop strategies to reach career objectives.

WM.02 **Describe and demonstrate the procedures related to workplace and job site safety including personal protective equipment, machine safety, and material handling practices.**

WM.02.01 Demonstrate safe material handling practices.

WM.02.02 Demonstrate and explain knowledge of workplace safety procedures.*(A2)

WM.02.03 Demonstrate and explain knowledge of personal safety practices pertaining to eye wear, footwear, clothing, and personal protective equipment (PPE) used in wood technology.*(A3)

WM.02.04 Describe safety practices for specific machines.

WM.02.05 Demonstrate knowledge of proper use, storage, and disposal of hazardous materials following OSHA's proper safety practices for a woodworking facility.*(A1)

WM.02.06 Obtain, read and follow SDS (Safety Data Sheets) information.

WM.02.07 Follow safe practices relating to environmental hazards.

WM.02.08 Explain safe proper use, disposal, and storage of chemicals following OSHA standards.*(A7)

WM.02.09 Describe safety practices for the following machines: table saw, drill press, stationary sander, router table, and miter saw.*(A4)

WM.03 **Identify and describe the safe and appropriate use of various types of hand and power tools and machinery used for building.**

WM.03.01 Identify, use, and maintain the following measuring, layout, and marking tools: steel rule, tape measure, combination square, sliding "T" bevel, and compass.*(B8)

WM.03.02 Identify proper use and function of the following portable power tools: circular saw, drill, jig/saber saw, finishing sanders, and routers.*(B9)

WM.03.03 Identify proper use and function of the following fastening tools: hammer, Phillip head screw driver, and slotted/flat head screw driver.*(B10)

WM.03.04 Demonstrate and explain knowledge of proper use and storage of portable power tools.*(A6)

WM.03.05 Demonstrate and explain knowledge of proper use and storage of basic hand tools.*(A5)

WM.03.06 Identify proper use and function of the following hand tools: cross cut saw, rip saw, level, coping saw, nail set, hand plane, chisel, and file.*(B11)

WM.03.07	Identify proper use and function of stationary saws.
WM.03.08	Identify the proper use and function specialty machinery (e.g. drill presses. jointers. surface planers. table saws. power miter saws. band saws. scroll saws. and stationary sanders.*
WM.03.09	Identify proper use and function of the table and miter saws.*(B12)
WM.03.10	Explain and demonstrate correct use of planers.
WM.03.11	Explain and demonstrate use of molders
WM.03.12	Identify functions and demonstrate us of wood lathes.
WM.03.13	Identify and demonstrate use and function of sanders.
WM.03.14	Select appropriate tools, procedures, and/or equipment.
WM.03.15	Follow laboratory safety rules and procedures.
WM.03.16	Demonstrate good housekeeping at a workstation within total laboratory.
WM.03.17	Identify color coding safety standards.
WM.03.18	Explain fire prevention and safety precautions and practices for extinguishing fires.
WM.03.19	Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment.
WM.04	**Explain and be able to demonstrate the methods involved in turning raw materials into useable products.**
WM.04.01	Describe and interpret technical drawings.
WM.04.02	Describe and prepare rough drawings and sketches.*(C14)
WM.04.03	Explain and prepare a cut list or bill of material from a basic plan and assembly drawing.(C15)
WM.04.04	Interpret a design to facilitate replication
WM.04.05	Describe and identify fractional measurements from a basic plan and assembly drawings.*(C13)
WM.04.06	Identify the difference between both nominal and actual dimensions.*(C17)
WM.04.07	Extrapolate information from a set of plans.
WM.04.08	Measure accurately to a sixteenth of an inch.*(C16)
WM.04.09	Estimate materials quantities in both board feet and linear feet.*(C18)
WM.04.10	Interpret a design to facilitate replication Prepare stock for use.*(G28)
WM.04.11	Consider the natural characteristics of grain, knots, and checks when laying out a board.*(C19)
WM.04.12	Identify and assemble the following types of joints: butt, miter, dado, rabbet, and lap.*(G27)

WM.04.13	Identify and select the proper cutting process based on grain direction.*(E23)
WM.04.14	Identify how grain direction affects a material's strength.*(E24)
WM.04.15	Understanding kerf and its application to cutting and layout operations.*(E25)
WM.04.16	Identify characteristics and applications of the following coniferous softwoods: pine, cedar, and fir.*(D20)
WM.04.17	Identify characteristics and applications of the following deciduous hardwoods: oak, maple, and poplar.*(D21)
WM.04.18	Identify characteristics and applications of the following engineered lumber: plywood and medium density fiberboard.(D22)
WM.04.19	Identify and describe the purpose and use of the following woodworking fasteners: common nails, round head screws, flat head screws, and oval head screws.*(H29)
WM.04.20	Identify, describe purpose of and use woodworking adhesives.*
WM.04.21	Identify and describe the purpose of the following clamping devices: bar clamp, c-clamp, parallel/hand screw clamp, and spring clamps.*(H30)
WM.04.22	Identify and apply various wood finishes for interior and exterior, with brush or wipe on, for the following: paint, stain, and clear coat.*(I31)
WM.04.23	Describe the abrasive grit numbering grading system.*(F26)
WM.04.24	Differentiate among various abrasive materials.
WM.05	**Describe and demonstrate the attributes of wood design.**
WM.05.01	Utilize the design process; including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.
WM.05.02	Check and critique a design continually, and improve and revise the idea of the design as needed.
WM.05.03	Design and create cabinet and wood products
WM.05.04	Develop a production plan, including the layout, bill of materials, and cost analysis, for the production of cabinets or wood products.
WM.06	**Read blueprints and specifications.**
WM.06.01	Explain the purpose and components of contract documents and specifications.
WM.06.02	Identify and explain the following elements: Dimensions; Construction views; Section views; Site plans; Foundation plans; Floor plans and elevations; Details; Wiring details.
WM.06.03	Identify building symbols.
WM.06.04	Identify lists of materials and specifications.

WM.06.05 Use architectural and engineering scales.

WM.06.06 Demonstrate a basic understanding of computer-aided design.

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

This course is designed to develop knowledge of automotive design, construction and operation. Students are lead, component by component, through basic auto systems, building a sound understanding of each system and its function in the automobile. The course will be taught from a hands-on, problem-solving approach through the use of demonstration models and “live” automobiles.

Credit: 0.5

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

UNIT 1: SAFETY

Objectives
Students will define some of the safety concerns in an auto repair lab.
Students will discuss personal responsibility for individual and group safety.
Students will indicate the locations of emergency stop buttons, exits, exit routes, eyewash station, first aid kit, and firefighting equipment.

Essential Questions
What are the dangers in performing repair activities in the shop?
How can these dangers be reduced or eliminated?
Upon which trade or job position does responsibility lie for the safe performance, completion or quality of a given repair operation?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Safety is a personal and a group responsibility. The Automotive repair industry is an occupation in which many dangers can be minimized with forethought and an appropriate attitude.	Practice emergency drills for fire and injury. Students will pass a prescribed safety instruction unit before using the lab, tools, or equipment. Instructor monitors continuously, and students practice mutual feedback for compliance with safety procedures.	Appropriate performance on student evaluation and/or classroom participation. Use of the Tech. Ed. Department PLC safety unit to prepare and monitor student safety preparation and practices.

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

UNIT 2: TOOL IDENTIFICATION AND USE

Objectives
Students will identify the most common automotive tools.
Students will describe commonly used measuring tools.
Students will describe commonly used test equipment.
Students will select the correct tool for a given job.

Essential Questions
What three true statements can you make about good quality tools?
An outside micrometer can be used to check what item/s during disassembly of an automotive engine?
How many kinds of electrical properties can a multimeter measure?
How should you arrange your tools in the toolbox so that the tools that are most often used are ready?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Most professional auto mechanics buy tools that have a lifetime guarantee. A competent automotive technician uses precision measuring tools on the job.	Obtain catalogs from various tool manufacturers and make a list of the tools that you will need to get started as an automotive technician. List additional tools that you would need to become a(n): • Drivability technician. • Engine overhaul technician. • Transmission repair technician. • Air conditioning technician. • Brake technician. Figure out the costs of the tools listed in above. Determine the total investment needed to get started as an automotive technician. List at least three areas of automotive repair where accurate measurements are absolutely necessary. List some areas of automotive repair where accurate measurements are less critical. Discuss your lists with other members of your class.	Appropriate performance on student evaluation and/or classroom participation.

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

UNIT 3: ENGINE DESIGN, CONSTRUCTION, CLASSIFICATION AND LUBRICATION

Objectives

Students will identify the basic parts of an engine, and their functions.
Students will explain engine-operating principles.
Students will describe the function of the major parts of an engine and valve train.
Students will describe the four-stroke cycle sequence.
Students will describe engine part design.
Students will explain the construction of engine components.
Students will define the purpose of each engine part.
Students will compare four-stroke and two-stroke cycle engines.
Students will explain the different engine classifications such as "V", Inline, and Horizontally Opposed.

Essential Questions

When the gasoline explodes in the cylinder, what movable part of the engine first receives the force?
What are the four strokes of a four-cycle engine?
What is the purpose of the engine block?
What is the main advantage of using aluminum instead of cast iron in engine construction?
What engine parts convert linear motion to rotary motion?
What is a reasonable oil change interval?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A one-cylinder small gas engine uses the same fundamentals components as a multi-cylinder automotive engine.	Given the tools and equipment, disassemble, identify, and reassemble the parts of a one cylinder small gas engine or four/six cylinder automotive engine.	Appropriate performance on student evaluation and/or classroom participation.
A good auto mechanic not only understands engine operation principles, but also engine design and construction.	Inspect engine block; inspect and measure cylinder wall/s, camshaft bearings, crankshaft and rod bearings, and determine needed repairs.	
An experienced automotive technician can glance at an engine and describe a long list of engine facts.	Perform oil change.	

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

UNIT 4: IGNITION SYSTEMS

Objectives
Students will describe the primary circuits of an ignition system.
Students will describe the secondary circuits of an ignition system.
Students will list the differences between a contact point and a solid-state electronic ignition system.
Students will explain how a distributor-less ignition system operates.

Essential Questions
When gapping spark plugs, which electrode do you bend/adjust?
What is the maximum voltage that some modern electronic ignition systems can produce?
What is the major difference between electronic and contact point ignition systems?
What is the primary job of the ignition coil?
What are three main advantages of a computer-control ignition system?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
An ignition system has two jobs: to increase battery voltage and to send this voltage to the right spark plug at the right time.	Examine one or more ignition systems and determine which of the following classes it fits into: point-type; electronic with vacuum and centrifugal advance mechanism; computer controlled; distributor-less. Inspect and test ignition primary and secondary circuit wiring and components. Check and adjust (where applicable) ignition system timing.	Appropriate performance on student evaluation and/or classroom participation.
If any ignition system component is not functioning properly, engine performance will be reduced.		
The theory, design, and construction of the ignition system and how its components are combined to produce, control, and distribute the spark.		

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

UNIT 5: FUEL SYSTEMS

Objectives
Students will describe the major parts of a gasoline fuel injection system.
Students will identify the parts of fuel injection system.
Students will summarize the operating principles of fuel injection system.
Students will describe the components of the fuel supply system.
Students will explain the basic function of the fuel pump.
Students will identify the basic parts of a carburetor.
Students will summarize carburetor-operating principles.

Essential Questions
What is the most important thing to remember when removing and replacing a fuel tank?
When removing fuel supply lines or fuel filters from fuel-injected cars, how can you relieve residual pressure?
What are the two kinds of fuel injection systems?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The majority of gasoline injection systems are the electronically controlled types, while all diesel engines are the mechanical controlled types.	Inspect fuel tank and fuel cap; inspect and test mechanical and electrical fuel pumps. Replace fuel filters. Inspect and test fuel pressure regulation system and components of injection type fuel systems.	Appropriate performance on student evaluation and/or classroom participation.
Since all new vehicles have fuel injection system, it is important that you learn their operating principles.		
Although carburetors were phased out in the 1993 model year, millions of older cars and trucks are operating with carburetors.		

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

UNIT 6: HEATING AND COOLING SYSTEMS

Objectives
Students will list the functions of an engine cooling system.
Students will identify the two major kinds of cooling systems.
Students will identify the major components of liquid cooling system.
Students will trace the flow of coolant through the liquid cooling system.
Students will identify the three methods of heat transfer.
Students will explain the basic operation of the heater system.

Essential Questions
When pressure testing the cooling system what determines the maximum pressure to be used?
When flushing the cooling system what position should the heater control be in?
What are the three jobs that the cooling system must perform?
What is the purpose of the thermostat?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Without a properly operating cooling system, combustion heat can transfer into the engine parts making cylinder heads crack or warp, pistons melt, piston rings and cylinder walls score, or other parts fail.	Inspect coolant; drain, flush, refill, and bleed cooling system with recommend coolant. Obtain an antifreeze tester and test the antifreeze in a vehicle. Discuss whether the vehicle has sufficient freezing and corrosion protection. Inspect and replace engine cooling and heater system hoses. Inspect and test radiator, pressure cap, and recovery system.	Appropriate performance on student evaluation and/or classroom participation.

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

UNIT 7: ELECTRICAL SYSTEMS

Objectives

Students will name the variable used to measure electricity.
Students will list the basic types of electrical circuits.
Students will identify and define chassis wiring and related electronic components.
Students will identify and define circuit protection devices.
Students will identify and define common vehicle chassis lights.
Students will identify and define chassis electrical equipment.
Students will describe the construction and operation of an automotive battery.
Students will explain the operating principles of a charging and starting system.
Students will identify the major parts of a charging and starting system.

Essential Questions

What instrument is used to test battery electrolyte specific gravity?
If a defective battery is found, can it be assumed that the rest of the starting and charging system is satisfactory?
Why should the battery be disconnected before doing any major electrical repairs?
What two devices are able to charge a battery?
What are the three most common types of circuit protection devices?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Today's automotive technician must have a working knowledge of electricity and electronics to service and repair the electrical components. The chassis electrical system operates a vast number of lights, solenoids, relays, motors, and electronic devices. Components such as those found in the charging and starting system, the ignition, fuel injection, emission controls, electronic control unit, air conditioner, lights, and radio rely upon an automobile's electrical system.	Use a multimeter or VOM to test a chassis electrical component and/or wiring. Tests should include measuring voltage drop across the components in a live circuit, checking the resistance of de-energized components, and measuring amperage draw of a working circuit. Remove, clean, and install the terminals of a battery. Use a battery charger to recharge a battery in a vehicle. Demonstrate the proper method of isolating the battery and charger from the rest of the vehicle electrical system, and the correct way of connecting the charger cables to the battery. Using shop test equipment, test the battery in a vehicle. Also perform a hydrometer test if possible. Compare the two readings to determine the state of charge of the battery.	Appropriate performance on student evaluation and/or classroom participation.

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

UNIT 8: EXHAUST, EMISSIONS, AND COMPUTER SYSTEMS

Objectives

Students will explain the purpose of the exhaust system.
Students will describe the operation of the exhaust system.
Students will identify exhaust system components.
Students will define automotive emissions.
Students will list the three most harmful components in automotive emissions.
Students will explain the operating principles of common emission control systems.
Students will identify the major parts of a common emission control system.
Students will explain why computers are used in modern vehicles.
Students will describe computer control system operation.

Essential Questions

What are the five major parts of a typical exhaust system?
What emission control component is the oldest? What does it control?
What is the purpose of the catalytic converter?
What are the three exhaust gases that must be controlled to reduce air pollution?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Careless installation can cause leaks allowing gases to enter the passenger compartment, which can cause breathing difficulties and carbon monoxide poisoning.	Check the exhaust components on a specific vehicle for damage. Make a sketch of the system and label any defects that you found. Determine whether the defective parts can be fixed or if new parts are required. Inspect a vehicle and locate the emissions systems components. List all components and give their function. Determine whether the vehicle has any internal emission controls, such as engine modifications. Obtain a copy of the latest Environmental Protection Agency (EPA) publications on air pollution, fuel mileage, and oxygenated gasoline. The EPA's phone number is listed in your local telephone book. Review the materials and write a short report summarizing them.	Appropriate performance on student evaluation and/or classroom participation.
Modern emission controls are integral part of the engine and drivetrain, and they must be serviced, not disabled or removed.		
These modern systems are fully integrated into the overall engine system and are usually monitored and controlled by the engine control computer.		

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

UNIT 9: BRAKE SYSTEMS

Objectives
Students will describe the principles used for the brakes' hydraulic system operation.
Students will identify the basic parts of the brake hydraulic system.
Students will explain the differences between drum, disc, and parking brakes.
Students will describe the principles and components of the power-brake and anti-lock brake systems.
Students will list the safety hazards and precautions involved in brake system repairs.

Essential Questions
What are five important items to be checked during a brake inspection?
Should one start the brake bleeding process by bleeding the wheel cylinder or caliper that is the closest or the farthest away from the master cylinder?
What is the purpose of the anti-lock brake system (ABS)?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Since brake linings work in part by wearing, brake service is an inevitable part of automotive life. An automotive technician will be involved in brake work sooner or later, and should learn to service brakes as efficiently as possible.	Inspect brake pads/shoes for wear; flexible brake hoses/lines for leaks, kinks, cracks, bulging or wear; tighten loose fittings and supports. Select, handle, store, and install brake fluids to proper level. Following the manufacturer's procedures, bleed the anti-lock brake and non-anti-lock brake system's (ABS) front and rear hydraulic circuits.	Appropriate performance on student evaluation and/or classroom participation.

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

UNIT 10: CAREER OPPORTUNITIES IN THE AUTOMOTIVE FIELD

Objectives
Students will list general classes of jobs in automobile service and repair.
Students will list areas of specialization in automobile service and repair.
Students will explain job working conditions and salaries.
Students will list addresses or web sites of various organizations that offer information on automotive careers.

Essential Questions
Career opportunities in the automotive service industry have been very good in the past, and in the future, they look even better.
What shop employees overhaul engines, transmissions, and other major vehicle components?
Why would an employer prefer to hire a high school graduate?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
If one likes work that is mentally and physically demanding, diversified, and financially rewarding, auto service and repair may be for you. Career opportunities in the automotive service industry have been very good in the past, and in the future, they look even better.	Students will go to the library and research the career opportunities for automotive technician in your area. Find the average salary for a technician in your area. Visit two different repair shops in your area. Note the condition of the work areas, the appearance of the technicians and other personnel, and what types of jobs were being performed. Prepare a report for the class on your findings.	Appropriate performance on student evaluation and/or classroom participation.

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

AUTOMOTIVE CLASS RUBRIC

	4 Exceptional	3 Proficient	2 Minimal	1 inadequate	Score
Communicate in Standard English	Student demonstrates high skills in following direction, providing verbal discourse, and writing lab reports.	Student demonstrates average skills in following direction, providing verbal discourse, and/or writing lab reports.	Student demonstrates little skill in following direction, providing verbal discourse, and/or writing lab reports.	Little attempt at communication was evident, and/or no lab report was completed.	
Read and understand a variety of materials	Always reads a variety of materials for a complete understanding of the task at hand.	Reads a variety of materials related to the task at hand.	Most of the time material is read for the task at hand.	Seldom reads any material for the task at hand.	
Apply mathematical principles to solve and justify problems	Student demonstrates high skill in problem comprehension, problem application, and accurate evaluation of the problem.	Student demonstrates average skill in problem comprehension, problem application, and/or accurate evaluation of the problem.	Student demonstrates little skill in problem comprehension, problem application, and/or accurate evaluation of the problem.	Little attempt at a mathematical solution to problem is attempted or comprehended.	
Evaluate information to interpret events and make informed responses	The student develops and demonstrates a planned, logical, clear and well thought approach to the solution of a complex task or problem.	The student develops and demonstrates a planned logical approach but must modify the methods and process to complete the task or problem.	The student develops an approach but lacks clarity and evidence of planning.	The approach taken by the student is disorganized, unclear, and haphazard with no logical sequence.	
Apply scientific principles to solve problems	Student effectively, logically, and appropriately incorporates the principles of science to solve problems.	Student incorporates the principles of science to solve problems.	Student attempts to incorporate the principles of science to solve problems.	No attempt is made to incorporate the principles of science to the problem at hand.	
Utilizes technology to organize and solve problems	The student always chooses the appropriate technology to successfully accomplish a task.	The student demonstrates the use of some appropriate technologies including various tools to successfully accomplish a task or solution.	The student demonstrates limited use of technologies to successfully accomplish a task or solution.	The student rarely demonstrates the use of technologies when solving problems or tasks.	

AUTO MECHANICS FUNDAMENTALS
GRADES 9-12

RESOURCES

Auto Fundamentals by M. W. Stockel, M. T. Stockel, and C. Johanson
Introductory Auto Mechanics by D. Karwatha, J. Van DePolder, and M. Wheeler

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: Safety	X	
Unit 2: Tool Identification and Use	X	
Unit 3: Engine Design, Construction, Classification and Lubrication	X	
Unit 4: Ignition Systems	X	
Unit 5: Fuel Systems	X	
Unit 6: Heating and Cooling Systems	X	
Unit 7: Electrical Systems		X
Unit 8: Exhaust, Emissions, and Computer Systems		X
Unit 9: Brake Systems		X
Unit 10: Career Opportunities in the Automotive Field		X

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

This course will meet for the full year and is designed to develop knowledge of automotive design, construction and operation. Students are lead, component by component, through basic auto systems, building a sound understanding of each system and its function in the automobile. The course will be taught from a hands-on, problem-solving approach through the use of demonstration models and “live” automobiles.

Credit: 1.0

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

UNIT 1: SAFETY

Objectives
Students will define some of the safety concerns in an automotive la lab.
Students will discuss personal responsibility for individual and group safety.
Students will indicate the locations of emergency stop buttons, exits, exit routes, eyewash station, first aid kit, and firefighting equipment.

Essential Questions
What are the dangers in performing automotive repair activities in the shop?
How can these dangers be reduced or eliminated?
Upon which trade or job position does responsibility lie for the safe performance, completion or quality of a given operation?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Safety is a personal and a group responsibility. Auto Mechanic is an occupation whose many dangers can be minimized with forethought and an appropriate attitude.	Practice emergency drills for fire and injury. Students will pass a prescribed safety instruction unit before using the lab, tools, or equipment. Instructor monitors continuously, and students practice mutual feedback for compliance with safety procedures.	Appropriate performance on student evaluation and/or classroom participation.

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

UNIT 2: TOOL IDENTIFICATION AND USE

Objectives
Students will identify the most common automotive tools.
Students will describe commonly used measuring tools.
Students will describe commonly used test equipment.
Students will select the correct tool for a given job.

Essential Questions
What three true statements can you make about good quality tools?
An outside micrometer can be used to check what item/s during disassembly of an automotive engine?
How many kinds of electrical properties can a multimeter measure?
How should you arrange your tools in the toolbox so that the tools that are most often used are ready?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Most professional auto mechanics buy tools that have a lifetime guarantee. A competent automotive technician uses precision measuring tools on the job.	Obtain catalogs from various tool manufacturers and make a list of the tools that you will need to get started as an automotive technician. List additional tools that you would need to become a(n): • Drivability technician. • Engine overhaul technician. • Transmission repair technician. • Air conditioning technician. • Brake technician. Figure out the costs of the tools listed above. Determine the total investment needed to get started as an automotive technician. List at least three areas of automotive repair where accurate measurements are absolutely necessary. List some areas of automotive repair where accurate measurements are less critical. Discuss your lists with other members of your class.	Appropriate performance on student evaluation and/or classroom participation.

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

UNIT 3: ENGINE DESIGN, CONSTRUCTION, CLASSIFICATION AND LUBRICATION

Objectives

Students will identify the basic parts of an engine, and their functions.
Students will explain engine-operating principles.
Students will describe the function of the major parts of an engine and valve train.
Students will describe the four-stroke cycle sequence.
Students will describe engine part design.
Students will explain the construction of engine components.
Students will define the purpose of each engine part.
Students will compare four-stroke and two-stroke cycle engines.
Students will explain the different engine classifications such as "V", Inline, and Horizontally Opposed.

Essential Questions

When the gasoline explodes in the cylinder, what movable part of the engine first receives the force?
What are the four strokes of a four-cycle engine?
What is the purpose of the engine block?
What is the main advantage of using aluminum instead of cast iron in engine construction?
What engine parts convert linear motion to rotary motion?
What is a reasonable oil change interval?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A one-cylinder small gas engine uses the same fundamentals components as a multi-cylinder automotive engine.	Given the tools and equipment, disassemble, identify, and reassemble the parts of a one cylinder small gas engine or four/six cylinder automotive engine. Inspect engine block; inspect and measure cylinder wall/s, camshaft bearings, crankshaft and rod bearings, and determine needed repairs. Perform oil change.	Appropriate performance on student evaluation and/or classroom participation.
A good auto mechanic not only understands engine operation principles, but also engine design and construction.		
An experienced automotive technician can glance at an engine and describe a long list of engine facts.		

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

UNIT 4: IGNITION SYSTEMS

Objectives

Students will describe the primary circuits of an ignition system.
Students will describe the secondary circuits of an ignition system.
Students will list the differences between a contact point and a solid-state electronic ignition system.
Students will explain how a distributorless ignition system operates.
Students will explain how a compression ignition system operates.

Essential Questions

When gapping spark plugs, which electrode do you bend/adjust?
What is the maximum voltage that some modern electronic ignition systems can produce?
What is the major difference between electronic and contact point ignition systems?
What is the primary job of the ignition coil?
What are three main advantages of a computer-control ignition system?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
An ignition system has two jobs: to increase battery voltage and to send this voltage to the right spark plug at the right time.	Examine one or more ignition systems and determine which of the following classes it fits into: point-type; electronic with vacuum and centrifugal advance mechanism; computer controlled; distributorless. Inspect and test ignition primary and secondary circuit wiring and components. Check and adjust (where applicable) ignition system timing.	Appropriate performance on student evaluation and/or classroom participation.
If any ignition system component is not functioning properly, engine performance will be reduced.		
The theory, design, and construction of the ignition system and how its components are combined to produce, control, and distribute the spark.		

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

UNIT 5: FUEL SYSTEMS

Objectives

Students will describe the major parts of fuel injection, and air induction systems.
Students will identify the parts of fuel injection system.
Students will summarize the operating principles of fuel injection system.
Students will compare supercharger and turbocharger operation.
Students will describe the components of the fuel supply system.
Students will explain the basic function of the fuel pump.
Students will identify the basic parts of a carburetor.
Students will summarize carburetor operating principles.

Essential Questions

What is the most important concept to remember when removing and replacing a fuel tank?
When removing fuel supply lines or fuel filters from fuel-injected cars, how can residual pressure be relieved?
What are the two kinds of fuel injection systems?
What are the four basic parts of the pulse fuel injection system?
What is the purpose of the cold start injector?
What are three major advantages of the fuel injection system, compared to the carburetor fuel system?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The majority of fuel injection systems are the electronically controlled types, while all diesel engines are the mechanical controlled types.	Inspect fuel tank and fuel cap; inspect and test mechanical and electrical fuel pumps; replace fuel filters. Inspect and test fuel pressure regulation system and components of injection type fuel systems; remove, clean, and reinstall throttle body. Check/adjust idle speed and fuel mixture where applicable on carburetor fuel systems. Diagnose hot or cold no starting, hard starting, poor drivability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, poor mileage, dieseling, and emissions problems on vehicles with carburetor and injection type fuel systems.	Appropriate performance on student evaluation and/or classroom participation.
Since all new vehicles have fuel injection systems, it is important that you learn their operating principles.		
Although carburetors were phased out in the 1993 model year, millions of older cars and trucks are operating with carburetors.		

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

UNIT 6: HEATING AND COOLING SYSTEMS

Objectives

Students will list the functions of an engine cooling system.
Students will identify the two major types of cooling systems.
Students will identify the major components of liquid cooling system.
Students will trace the flow of coolant through the cooling system.
Students will identify the three methods of heat transfer.
Students will identify the basic parts of an air conditioning system.
Students will describe the operation of each air conditioning system component.
Students will explain the basic operation of the heater system.
Students will state basic refrigerant safety rules.

Essential Questions

When pressure testing the cooling system what determines the maximum pressure to be used?
When flushing the cooling system what position should the heater control be in?
What are the three jobs that the cooling system must perform?
What is the purpose of the thermostat?
The bypass valve prevents what problem?
What does the air condition do to the air entering the car?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Without a properly operating cooling system, combustion heat can transfer into the engine parts making cylinder heads crack or warp, pistons melt, piston rings and cylinder walls score or other parts fail. The air conditioning system on a car greatly affects its overall performance so it is important that the technician fully understand its operation.	Inspect coolant; drain, flush, refill, and bleed cooling system with recommend coolant. Obtain an antifreeze tester and test the antifreeze in a vehicle. Discuss whether the vehicle has sufficient freezing and corrosion protection. From the drivers' seat of a vehicle, perform an operational check on the heating and air conditioning system. Use a thermometer to check air conditioner output. Perform two tests, one in the shop and one outside. Inspect, replace, and adjust drive belts and pulleys. Inspect and replace engine cooling and heater system hoses. Inspect and test radiator, pressure cap, and recovery system.	Appropriate performance on student evaluation and/or classroom participation.

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

UNIT 7: ELECTRICAL SYSTEMS

Objectives

Students will name the values used to measure electricity.
Students will list the basic types of electrical circuits.
Students will explain how diodes work.
Students will identify and define chassis wiring and related electronic components.
Students will identify and define circuit protection devices.
Students will identify and define common vehicle chassis lights.
Students will identify and define chassis electrical equipment.
Students will describe the construction and operation of an automotive battery.
Students will explain the operating principles of a charging and starting system.
Students will identify the major parts of a charging and starting system.
Students will perform necessary procedures for the diagnosis of vehicle system malfunctions.
Students will document maintenance procedures.

Essential Questions

What instrument is used to test battery electrolyte specific gravity?
If a defective battery is found, can it be assumed that the rest of the starting and charging system is satisfactory?
Why should the battery be disconnected before doing any major electrical repairs?
How is the gage of a wire determined?
What is the wiring that is not directly connected to the engine called?
What two devices are able to charge a battery?
What is the primary job of the alternator?
What are the three most common types of circuit protection devices?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Today's automotive technician must have a working knowledge of electricity and electronics to service and repair the electrical components.	Use a multimeter or VOM to test a chassis electrical component and/or wiring. Tests should include measuring voltage drop across the components in a live circuit, checking the resistance of de-energized components, and measuring amperage draw of a working circuit. Remove, clean, and install the terminals of a battery. Use a battery charger to recharge a battery in a vehicle. Demonstrate the proper method of isolating the battery and charger from the rest	Appropriate performance on student evaluation and/or classroom participation.
The chassis electrical system operates a vast number of lights, solenoids, relays, motors, and electronic devices.		
Components such as those found in the		

Knowledge and Skills	Instructional Strategies	Evidence of Learning
charging and starting system, the ignition, fuel injection, emission controls, electronic control unit, air conditioner, lights, and radio rely upon an automobile's electrical system.	of the vehicle electrical system, and the correct way of connecting the charger cables to the battery. Using shop test equipment, test the battery in a vehicle. Also make a hydrometer test if possible. Compare the two readings to determine the state of charge of the battery. Using the shop equipment, check the electrical values (amperage and voltage) of a vehicle's starting and charging systems. Perform tests during cranking and as the running engine charges the battery. If the readings are not correct, try to find the reason.	

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

UNIT 8: EXHAUST, EMISSIONS, AND COMPUTER SYSTEMS

Objectives

Students will explain the purpose of the exhaust system.
Students will describe the operation of the exhaust system.
Students will identify exhaust system components, and perform inspection and service.
Students will define automotive emissions.
Students will list the three most harmful automotive emissions.
Students will explain the operating principles of common emission control systems.
Students will identify the major parts of common emission control system.
Students will explain why computers are used in modern vehicles.
Students will describe computer control system operation.
Students will describe the major components of an on-board computer.
Students will identify and describe computer input sensors and output devices.
Students will explain the advantages and disadvantages of the modern ECS.

Essential Questions

What are the five major parts of a typical exhaust system?
What emission control component was the first or oldest? What does it control?
What is the purpose of the under-hood emission information label?
What is the purpose of the catalytic converter?
What are three advantages of a computer controlled emission system?
What are the three exhaust gases that must be controlled to reduce air pollution?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Careless installation can cause leaks allowing gases to enter the passenger compartment, which can cause breathing difficulties and carbon monoxide poisoning.	Check the exhaust components on a specific vehicle for damage. Make a sketch of the system and label any defects that you found. Determine whether the defective parts can be fixed or if new parts are required. Inspect a vehicle and locate the emissions systems components. List all components and give their function. Determine whether the vehicle has any internal emission controls, such as engine modifications. Obtain a copy of the latest Environmental Protection Agency (EPA) publications on air pollution, fuel mileage, and oxygenated gasoline. The EPA's phone number is listed in your local telephone book. Review the	Appropriate performance on student evaluation and/or classroom participation.
Modern emission controls are integral part of the engine and drivetrain, and they must be serviced, not disabled or removed.		
These modern systems are fully		

Knowledge and Skills	Instructional Strategies	Evidence of Learning
integrated into the overall engine system and are usually monitored and controlled by the engine control computer.	materials and write a short report summarizing them. Locate an emission label on a late-model vehicle. Identify and study the instructions for setting timing or idle. Explain to classmates what the information means.	

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

UNIT 9: MANUAL AND AUTOMATIC TRANSMISSIONS, TRANSAXLES, AND 4WD

Objectives

Students will explain clutch operation.
Students will name the different types of clutches.
Students will explain how a manual transmission operates.
Students will identify the differences between a manual transmission and manual transaxle.
Students will identify the similarities between a manual transmission and manual transaxle.
Students will explain the purpose of four-wheel drive.
Students will explain the operation of the four-wheel drive transfer cases.
Students will explain how both automatic transmissions and transaxles function.
Students will identify the major components of an automatic transmission or transaxle.
Students will list the basic parts of a rear-wheel driveline.
Students will explain the function of each rear-wheel drive shaft part.
Students will list the basic parts of a front-wheel driveline.
Students will explain the function of each front-wheel drive axle part.
Students will describe the front drive axles used on four-wheel drive vehicles.

Essential Questions

How the fluid level of a manual transmission or transaxle checked?
How the fluid level of an automatic transmission or transaxle checked?
What is the purpose of the clutch?
What is the purpose of a four-wheel drive system?
On a full-time transfer case, when would the lockout be engaged?
How does the torque converter act like a fluid coupling?
What are the two front axle setups for four-wheel drive vehicles?
What is the purpose of a CV joint?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Although most vehicles have automatic transmissions or transaxles, many vehicles, especially economy cars and pickup trucks, have manual transmissions.	Service transmission; perform visual inspection; replace fluid and filters. Inspect, adjust, repair or replace hydraulic clutch slave and master cylinder.	Appropriate performance on student evaluation and/or classroom participation.
Modern automatic transmissions are partially or fully controlled by on-board	Inspect and replace clutch pressure plate assembly and clutch disc on a	

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

Knowledge and Skills	Instructional Strategies	Evidence of Learning
computers. Once only used by military personnel, forest rangers, and hunters, four-wheel drive vehicles are now commonly used for commuting and shopping.	rear wheel drive vehicle. Inspect, service and replace front-wheel drive (FWD) and rear-wheel drive (RWD) shafts, yokes, and boots. Inspect and replace rear axle shaft wheel studs. Inspect, service, and replace front-wheel bearings and locking hubs.	

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

UNIT 10: BRAKE SYSTEMS

Objectives
Students will describe the principles used for the brakes' hydraulic system operation.
Students will identify the basic parts of the hydraulic brake system.
Students will explain the differences between drum and disc brakes.
Students will describe the principles and components of the disc, drum, anti-lock brake, and parking brake systems.
Students will list the safety hazards and precautions involved in the brake system repairs.

Essential Questions
What are five important items to be checked during a brake inspection?
Does the primary brake shoe face the back or front of the vehicle?
Should one start the brake bleeding process by bleeding the wheel cylinder or caliper that is the closest or the farthest away from the master cylinder?
After installing new brake pads, what should be done before moving the vehicle?
Why did the dual piston master cylinder replace the single piston master cylinder?
What is the purpose of the anti-lock brake system (ABS)?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Since brake linings work in part by wearing, brake service is an inevitable part of automotive life.	Inspect brake pads/shoes for wear; flexible brake hoses/lines for leaks, kinks, cracks, bulging or wear; tighten loose fittings and supports.	Appropriate performance on student evaluation and/or classroom participation.
An automotive technician, will be involved in brake work sooner or later, and should learn to service brakes as efficiently as possible.	Select, handle, store, and install brake fluids to proper level.	
Anti-lock brakes are becoming increasingly common on new vehicles for reasons including safety and efficiency.	Following the manufacturer's procedures, bleed the anti-lock brake and non-anti-lock brake system's (ABS) front and rear hydraulic circuits. Observe anti-lock brake system (ABS) warning light(s)s at startup: determine if further diagnosis is needed.	

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

UNIT 11: SUSPENSION SYSTEMS, STEERING SYSTEMS, AND WHEEL ALIGNMENT

Objectives

Students will identify the purpose of the suspension and define terms such as caster, camber, and toe in/out. .
Students will name the different types of vehicles frames.
Students will explain the differences between conventional and MacPherson strut suspensions.
Students will explain the operation of front and rear suspension components.
Students will identify the major parts and explain the operation of a parallelogram power steering system.
Students will identify the major parts and explain the operation of a rack-and-pinion power steering system.
Students will describe basic wheel rim design and construction.
Students will describe various types of wheel hubs and bearings.
Students will explain different tire construction, and its effect on tire wear.
Students will identify tire and wheel size designations.
Students will select appropriate tire inflation and rotation procedures.
Students will explain the purpose of wheel alignment.
Students will identify the most common related wheel alignment angles.
Students will identify vehicle alignment adjustment devices.
Students will identify suspension, steering, and tire factors, which could affect alignment.

Essential Questions

How can shock absorbers and MacPherson struts be checked for wear?
Worn tie rod ends can cause what kind of steering system problems?
Improper wheel balancing can cause what type of tire wear problems?
Why is a torque stick used when tightening an aluminum or composite wheel rim with an impact wrench?
What is the greatest advantage of the independent front wheel suspension system?
What does the front wheels swivel/turn on?
Most modern vehicles are designed use to what type of power steering fluid?
What are custom wheel rims made from?
What are the two main functions of vehicle tires?
How does high-speed affect tire wear?
How does under or over inflation affect tire wear?
What does proper wheel alignment ensure?
What four major parts can wear out and affect alignment?

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

Knowledge and Skills	Instructional Strategies	Evidence of Learning
To improve fuel economy and performance, today's vehicles are being built much lighter and require more sophisticated suspension systems to preserve ride quality. Although rack and pinion steering systems are used in most late-model vehicles, many large cars and trucks continue to use the conventional parallelogram linkage steering system. The increased use of custom wheels and front wheel drives, the adoption of metric measurements, and the increased use of radial tires, continue to change size, rating, and service information. Proper tire inflation and alignment is critical to vehicle handling and tire wear.	Inspect and fill manual power steering fluid levels and condition. Inspect, adjust or replace power steering pump belt. Inspect tie rod ends (sockets), tie rod sleeves, and clamps. Inspect pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings and steering linkage damper. Inspect shocks and struts; determine needed repairs. Inspect upper and lower ball joints; determine needed repairs. Lubricate suspension and steering systems. Remove, inspect and service or replace front, or rear-wheel bearings. Diagnose unusual tire wear patterns; determine needed repairs. Inspect tires; check and adjust air pressure. Rotate tires according to manufacturer's recommendations. Balance wheel and tire assembly (static and dynamic). Dismount, inspect, repair, and remount tire on wheel; reinstall wheel; torque lug nuts.	Appropriate performance on student evaluation and/or classroom participation.

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

UNIT 12: CAREER OPPORTUNITIES IN THE AUTOMOTIVE FIELD

Objectives

Students will list general classes of jobs in automobile service and repair.
Students will list areas of specialization in automobile service and repair.
Students will generate repair orders, including flat-rate hourly labor charges.
Students will explain job working conditions and salaries.
Students will list addresses or web sites of various organizations that offer information on automotive careers.

Essential Questions

How are most automotive technicians paid?
What shop employees overhaul engines, transmissions, and other major vehicle components?
Why would an employer prefer to hire a high school graduate?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
If one likes work that is mentally and physically demanding, diversified, and financially rewarding, auto service and repair may be for you.	Go to the library and research the career opportunities for automotive technician in your area. Find the average salary for a technician in your area.	Appropriate performance on student evaluation and/or classroom participation.
Career opportunities in the automotive service industry have been very good in the past, and in the future, they look even better.	Visit two different repair shops in your area. Note the condition of the work areas, the appearance of the technicians and other personnel, and what types of jobs were being performed. Prepare a report for the class on your findings.	

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

AUTOMOTIVE CLASS RUBRIC

	4 Exceptional	3 Proficient	2 Minimal	1 inadequate	Score
Communicate in Standard English	Student demonstrates high skills in following direction, providing verbal discourse, and writing lab reports.	Student demonstrates average skills in following direction, providing verbal discourse, and/or writing lab reports.	Student demonstrates little skill in following direction, providing verbal discourse, and/or writing lab reports.	Little attempt at communication was evident, and/or no lab report was completed.	
Read and understand a variety of materials	Always reads a variety of materials for a complete understanding of the task at hand.	Reads a variety of materials related to the task at hand.	Most of the time material is read for the task at hand.	Seldom reads any material for the task at hand.	
Apply mathematical principles to solve and justify problems	Student demonstrates high skill in problem comprehension, problem application, and accurate evaluation of the problem.	Student demonstrates average skill in problem comprehension, problem application, and/or accurate evaluation of the problem.	Student demonstrates little skill in problem comprehension, problem application, and/or accurate evaluation of the problem.	Little attempt at a mathematical solution to problem is attempted or comprehended.	
Evaluate information to interpret events and make informed responses	The student develops and demonstrates a planned, logical, clear and well thought approach to the solution of a complex task or problem.	The student develops and demonstrates a planned logical approach but must modify the methods and process to complete the task or problem.	The student develops an approach but lacks clarity and evidence of planning.	The approach taken by the student is disorganized, unclear, and haphazard with no logical sequence.	
Apply scientific principles to solve problems	Student effectively, logically, and appropriately incorporates the principles of science to solve problems.	Student incorporates the principles of science to solve problems.	Student attempts to incorporate the principles of science to solve problems.	No attempt is made to incorporate the principles of science to the problem at hand.	
Utilizes technology to organize and solve problems	The student always chooses the appropriate technology to successfully accomplish a task.	The student demonstrates the use of some appropriate technologies including various tools to successfully accomplish a task or solution.	The student demonstrates limited use of technologies to successfully accomplish a task or solution.	The student rarely demonstrates the use of technologies when solving problems or tasks.	

AUTO MECHANICS FUNDAMENTALS (FULL YEAR)
GRADES 9-12

RESOURCES

Auto Fundamentals by M. W. Stockel, M. T. Stockel, and C. Johanson
Introductory Auto Mechanics by D. Karwatha, J. Van DePolder, and M. Wheeler

PACING GUIDE

Unit	Semester 1	Semester 2
Unit 1: Safety	X	
Unit 2: Tool Identification and Use	X	
Unit 3: Engine Design, Construction, Classification and Lubrication	X	
Unit 4: Ignition Systems	X	
Unit 5: Fuel Systems	X	
Unit 6: Heating and Cooling Systems	X	
Unit 7: Electrical Systems	X	X
Unit 8: Exhaust, Emissions, and Computer Systems		X
Unit 9: Manual and Automatic Transmissions, Transaxles and 4WD		X
Unit 10: Brake Systems		X
Unit 11: Suspension Systems, Steering Systems, and Wheel Alignment		X
Unit 12: Career Opportunities in the Automotive Field		X

ADVANCED AUTO MECHANICS
GRADES 9-12

Students with basic knowledge of the various automotive systems will learn how to service, troubleshoot and repair modern automobiles. It teaches essential skills, encourages the development of good work habits and stresses safety. With each year of Advanced Auto Mechanics, the student will be able to expand their knowledge on an individual basis.

Credit: 1.0

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 1: SAFETY AND ENVIRONMENTAL PROTECTION

Objectives

Students will identify the major causes of accidents.
Students will explain why accidents must be avoided.
Students will recognize unsafe conditions in the shop.
Students will give examples of unsafe work procedures.
Students will use personal protective equipment.
Students will describe types of environmental damage caused by improper auto shop practices.
Students will identify ways to prevent environmental damage.
Students will identify applicable OSHA regulations.

Essential Questions

What is the most important part of working safely?
What is a Material Safety Data Sheet?
When should the technician wear eye protection?
When should the technician wear respiratory protection?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Adopting safety on the job will ensure that the mechanic will not have a serious accident. Various types of protective equipment are needed to protect the eyes, feet, lungs, and skin. Always make sure that all repair procedures are done as safely as possible.	Obtain a copy of the local newspaper and note the types of accidents that are serious enough to make news. Pay particular attention to accidents that occurred in the workplace. Answer the following questions for each accident. • How were people hurt? • How was property damaged? • What caused the accident? What accident prevention steps covered in this unit could have prevented the accident?	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 2: BASIC TOOLS, EQUIPMENT, AND MATERIALS

Objectives

Students will identify common automotive hand tools, precision measuring tools, and lifting equipment.
Students will describe the proper use of automotive hand tools, precision measuring tools, and lifting equipment.
Students will list the safety rules for automotive hand tools, precision measuring tools, and lifting equipment.
Students will identify commonly used automotive service equipment.
Students will describe the proper use of automotive service equipment.
Students will list the safety rules for automotive service equipment.
Students will identify types of service manuals and training materials.
Students will select and use the correct tools, equipment, and service manuals for a given job.

Essential Questions

What quality and selection of tools does an automotive technician need to service late-model vehicles properly and efficiently?
An outside micrometer can be used to check which item/s during disassembly of an automotive engine?
What type of manual/s would you consult if you want to find the latest information about a specific make's on-board computers?
What type of manual/s would you consult if you want to find wheel alignment specifications for a specific make automobile?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A well-selected set of tools will increase productivity, precision, and job satisfaction.	Students will work in groups in order to establish the perceived role of the automotive technician. Students will then brainstorm together in order to determine the scope for a course such as this. The groups will finally share their ideas in a class discussion.	Appropriate performance on student evaluation and/or classroom participation.
A competent automotive technician uses precision measuring tools on the job.		
Manuals often are used in servicing and repairing the automobile.		

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 3: ENGINE MECHANICAL TROUBLESHOOTING, SERVICE AND REPAIR

Objectives

Students will summarize preliminary test steps.
Students will perform a compression test.
Students will use a cylinder leakage detector.
Students will perform a vacuum test.
Students will check engine oil pressure.
Students will diagnose engine mechanical problems.
Students will describe general procedures for removing an engine from a car.
Students will list safety rules that apply to engine removal.
Students will describe general procedures for disassembling an engine.
Students will explain how to make visual checks of major engine parts.
Students will summarize a typical sequence for assembling an engine.
Students will describe how to install an engine in a car.
Students will make final checks before starting the engine.

Essential Questions

What would be the first step in diagnosing a vehicle owner's complaints?
Why are preliminary checks important?
What are the causes for low cylinder compression?
What are possible causes for low oil pressure?
An erratic vacuum reading can be caused by?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Most diagnosis can be accomplished if the mechanic approaches the problem in a logical and analytical manner. Hasty diagnosis will prolong the job, wasting both time and money.	Interpret and verify complaint; determine needed repairs. Listen to engine noises; determine needed repairs. Diagnose the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound; determine needed repairs. Perform cylinder leakage tests; determine needed repairs. Perform a compression test. Write down the readings for each cylinder. Calculate the percentage differences between the	Appropriate performance on student evaluation and/or classroom participation.

Knowledge and Skills	Instructional Strategies	Evidence of Learning
	highest reading and the lowest reading. Use a vacuum gauge to diagnose engine problems. Write down the readings at various engine speeds. Discuss the readings from the above tests with other members of your class and decide what they indicate about engine condition.	

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 4: IGNITION SYSTEM SERVICE

Objectives
Students will inspect, test, and repair electronic ignition systems.
Students will explain the difference between electronic ignition systems and computerized ignition systems.
Students will describe the purpose of the firing order information.
Students will explain how to adjust ignition timing.
Students will clean, inspect, test, and replace spark plugs.

Essential Questions
When gapping spark plugs, which electrode do you bend?
What monitors various operating conditions in a computerized ignition system?
How can it be determined if a vehicle's computerized ignition system is experiencing engine fault codes?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Servicing modern electronic and computer-controlled ignition systems can be simpler than servicing older systems.	Examine one or more ignition systems' and determine which of the following classes it fits into: Point-type. Electronic with vacuum and centrifugal advance mechanism. Computer controlled. Distributorless. With a diagnostic scanner diagnose vehicles with electronic and computer-controlled systems for various fault codes. Visually inspect the secondary ignition components for signs of arcing and flashover. Discuss your findings with your instructor or the other members of your class.	Appropriate performance on student evaluation and/or classroom participation.
Troubleshooting electronic and computer-controlled systems can be difficult since there is no way to detect problems in the electronic components by looking at them.		
The mechanic must adopt a logical approach to diagnosing and repairing ignition problems.		

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 5: FUEL SYSTEM SERVICE

Objectives

Students will describe the cleaning, removal, repair, and replacement of fuel tanks.
Students will service fuel filters.
Students will list the safety rules involved in fuel system service.
Students will explain mechanical fuel injection construction, operation, and service.
Students will describe the construction, operation, and service of pulsed and continuous electronic fuel injection.
Students will service different types of air cleaners.
Students will describe a fuel mileage test.
Students will detect intake manifold air leakage.

Essential Questions

What is the most important thing to remember about removing and replacing a fuel tank?
What two things should fuel pumps always be tested for?
Inertia switches will turn off the electric pump under what conditions?
When removing fuel supply lines or fuel filters from fuel-injected cars, how can residual pressure be relieved?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A good working fuel delivery system must provide a sufficient quantity of clean, filtered fuel to the engine to supply the carburetor, fuel injectors, or diesel injection pump.	Check fuel pump pressure on a vehicle with a mechanically operated fuel pump and write down your readings. What do the readings reveal about the condition of the pump? Check fuel pump pressure on a vehicle with an electrically operated fuel pump and write down your readings. What do the readings reveal about the condition of the pump? Inspect a fuel filter for clogging. Discuss your findings with your instructor or the class.	Appropriate performance on student evaluation and/or classroom participation.
The fuel delivery system affects the performance and dependability of the engine.		
Failure to perform service to the fuel system can often lead to fuel system failure leaving the vehicle stranded.		

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 6: HEATING AND COOLING SYSTEM SERVICE

Objectives

Students will explain the role of antifreeze in an engine cooling system.
Students will properly clean a cooling system.
Students will detect leaks in a cooling system.
Students will test a radiator pressure cap.
Students will list the safety rules dealing with cooling systems.
Students will inspect and replace cooling system hoses.
Students will inspect, replace, and adjust drive belts.
Students will test and replace thermostat.
Students will inspect, repair, and replace a coolant pump.

Essential Questions

When pressure testing the cooling system what determines the maximum pressure to be used?
When flushing the cooling system what position should the heater control be in?
Why was refrigerant-12 replaced by refrigerant-134a?
What is the purpose of the thermostat?
The bypass valve prevents what problem?
How does the air conditioner cool the air entering the car?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Without a properly functioning cooling system, a car's engine may overheat in a matter of minutes causing expensive or irreplaceable damage. Without a properly functioning heating and air conditioning system the vehicle interior climate can be seriously affected. Servicing air conditioners must be done correctly to avoid environmental damage.	Inspect coolant; drain, flush, refill, and bleed cooling system with recommended coolant. Obtain an antifreeze tester and test the antifreeze in a vehicle. Discuss whether the vehicle has sufficient freezing and corrosion protection. From the drivers' seat of a vehicle, perform an operational check on the heating and air conditioning system. Use a thermometer to check air conditioner output. Perform two tests, one in the shop and one outside. Inspect, replace, and adjust drive belts and pulleys.	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED AUTO MECHANICS
GRADES 9-12

Knowledge and Skills	Instructional Strategies	Evidence of Learning
	Inspect and replace engine cooling and heater system hoses. Inspect and test radiator, pressure cap, and recovery system.	

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 7: ELECTRICAL SYSTEM SERVICE

Objectives

Students will install, test, and service a battery.
Students will use jumper cables correctly.
Students will test, service and repair a starting or charging system.
Students will replace a starter or alternator.
Students will identify and define chassis wiring and related components.
Students will define basic electrical terms such as volts, amperes, and resistance.
Students will explain the differences between chassis wiring and engine wiring.
Students will troubleshoot and replace chassis electrical components.
Students will identify deferent types of automotive wiring.
Students will make basic wiring repairs.
Students will read wiring diagrams, and perform basic electrical calculations.
Students will perform basic circuit tests on both parallel and series circuits.

Essential Questions

Will a fuse automatically reset when it cools off?
Why are fusible links not replaced with regular wire?
Why should the air bag system be disconnected before attempting to service any component on or near the system's components?
What instrument is used to test battery electrolyte specific gravity?
If a defective battery is found, can it be assumed that the rest of the starting and charging system is satisfactory?
Why should the battery be disconnected before doing any major electrical repairs?
How is wire gauge determined?
What is the wiring that is not directly connected to the engine called?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The alternator and battery must handle the increased electrical load caused by optional equipment and electronic control systems that are almost universal.	Use a multimeter or VOM to test a chassis electrical component and/or wiring. Tests should include measuring voltage drop across the components in a live circuit, checking the resistance of de-energized components, and measuring amperage draw of a working circuit. Remove, clean, and install the terminals of a battery. Use a battery charger to recharge a battery in a vehicle.	Appropriate performance on student evaluation and/or classroom participation.
Components such as those found in the charging and starting system, the ignition, fuel injection, emission controls, electronic control unit, air conditioner, lights, and radio rely upon an		

ADVANCED AUTO MECHANICS
GRADES 9-12

Knowledge and Skills	Instructional Strategies	Evidence of Learning
automobile's electrical system. A working knowledge of the automotive elexctronics and wiring is expected of today's mechanic.	Demonstrate the proper method of isolating the battery and charger from the rest of the vehicle electrical system and the correct way of connecting the charger cables to the battery. Using shop test equipment, test the battery in a vehicle. Also make a hydrometer test if possible. Compare the two readings to determine the state of charge of the battery. Using the shop equipment, check the electrical values (amperage and voltage) of a vehicle's starting and charging systems. Perform tests during cranking and as the running engine charges the battery. If the readings are not correct, try to find the reason.	

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 8: EXHAUST, EMISSION, AND COMPUTER SYSTEM SERVICE

Objectives

Students will summarize muffler design and operation.
Students will remove and install mufflers, exhaust, and tailpipes.
Students will use specialized exhaust system service tools.
Students will describe fuel system modifications for reduced emissions.
Students will explain exhaust gas recirculation system operation, service, and repair.
Students will explain catalytic converter construction and operation.
Students will explain positive crankcase ventilation system operation, service, and repair.
Students will diagnose exhaust system and emission control problems utilizing a computerized scanner.
Students will explain engine computer control system operation.
Students will explain the function and operation of input sensors and output actuators.
Students will troubleshoot electronic control system problems and service sensors, actuators, and electronic control units.

Essential Questions

What are the five major parts of a typical exhaust system?
Why must catalytic converters have heat shielding?
What emission control component was the first or oldest? What does it control?
What is the purpose of the under-hood emission information label?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
While the job of the exhaust system is relatively simple—to remove engine exhaust gases—improper service procedures can cause engine damage, objectionable noise, or even death from carbon monoxide poisoning. By maintaining emission control systems, the automotive technician protects an extremely vital resource—the air that supports life on earth.	Check the exhaust components on a specific vehicle for damage. Make a sketch of the system and label any defects that you found. Determine whether the defective parts can be fixed or if new parts are required. Inspect a vehicle and locate the emissions systems components. List all components and give their function. Determine whether the vehicle has any internal emission controls, such as engine modifications. Obtain a copy of the latest Environmental Protection Agency (EPA) publications on air pollution, fuel mileage, and oxygenated gasoline. The EPA's phone number is listed in your local telephone book. Review the materials and write a short report	Appropriate performance on student evaluation and/or classroom participation.

Knowledge and Skills	Instructional Strategies	Evidence of Learning
	summarizing them. Locate an emission label on a late-model vehicle. Identify and study the instructions for setting timing or idle. Explain to your classmates what the information means.	

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 9: MANUAL, AUTOMATIC, AND TRANSAXLE SERVICE

Objectives

Students will explain the construction, operation, and service of diaphragm and coil spring clutches.
Students will explain manual transmission and transaxle construction and operation.
Students will explain four-wheel drive design and operation.
Students will define part-time and full-time four-wheel drive.
Students will explain automatic transmission and transaxle in-vehicle service and diagnosis.
Students will explain towing procedures for vehicles with automatic transmission and transaxles.
Students will perform automatic transmission and transaxle filter and fluid service.
Students will explain the construction and operation of front-wheel drive CV joints and axles.
Students will service CV axles, joints, and boots.

Essential Questions

How is the fluid level of a manual transmission or transaxle checked?
How is the fluid level of an automatic transmission or transaxle checked?
On a vehicle with four-wheel drive, which major drive train component receives engine power first?
Most vehicle manufacturers recommend periodic transmission or transaxle fluid and filter changes at what intervals?
What portion of a drive shaft is easily damaged by clamping in a vise?
What indicates a torn CV boot?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Although most vehicles have automatic transmissions or transaxles, many vehicles—especially economy cars and pickup trucks—have manual transmissions. Once only used by military personnel, forest rangers, and hunters, four-wheel drive vehicles are now commonly used for commuting and shopping. Modern automatic transmissions are partially or fully controlled by on-board computers.	Do a survey at your school to determine what percentage of the faculty, staff, and students owns vehicles with manual transmissions. How do your figures compare with the national average of about 10%? Check the fluid level of at least three each: manual and automatic transmissions or transaxles. Do a survey at your school to determine what percentage of the faculty, staff, and students owns vehicles with four-wheel drive systems. Also, ask whether the systems are full or part time. Write a short report explaining why you think four-wheel drive vehicles are becoming more popular.	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED AUTO MECHANICS
GRADES 9-12

Knowledge and Skills	Instructional Strategies	Evidence of Learning
	Change the fluid and filter of an automatic transmission or transaxle. Inspect the bottom of the pan for the presence of metal or sludge. Inspect a rear-wheel drive shaft for dry, loose U-joints and/or damage to the shaft. Make a report for your instructor. Inspect a front CV axle shaft for loose CV joints and leaking boots. Make a report for your instructor.	

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 10: BRAKE SYSTEM SERVICE

Objectives

Students will explain drum brake construction, operation, and service.
Students will summarize disc brake construction, operation, and service.
Students will explain the operation and service of power brakes.
Students will explain the operation service of disc, drum, anti-lock, and parking brake systems.
Students will describe master cylinder operation, construction, and service.
Students will diagnose hydraulic brake system problems.
Students will diagnose brake friction system problems.
Students will diagnose power brake system problems.

Essential Questions

What are five important items to be checked during a brake inspection?
Does the primary brake shoe face the back or front of the vehicle?
You should start the brake bleeding process by bleeding the wheel cylinder or caliper that is the closest or the farthest away from the master cylinder?
After installing new brake pads, what should be done before moving the vehicle?
Does the disc brake caliper have to be removed to replace the brake pads?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Recent trends to increase fuel economy have made auto manufacturers use lighter materials (aluminum and plastic) in place of the conventional cast iron components which may be more easily damaged.	Clean and inspect rotor; measure rotor with a dial indicator and a micrometer. Refinish rotor according to manufacturer's recommendations. Depressurize integral (high pressure) components of the anti-lock brake system (ABS) following manufacturer's procedures. Following the manufacturer's procedures, bleed the anti-lock brake system's (ABS) front and rear hydraulic circuits. Remove, clean (using proper safety procedures), inspect, and measure brake drums; service or replace as needed. Mount brake drum on lathe; machine braking surface.	Appropriate performance on student evaluation and/or classroom participation.
Anti-lock brakes are becoming increasingly common on new vehicles for reasons including safety and efficiency.		
As an automotive technician, you will be involved in brake work sooner or later, and you should learn to service brakes as efficiently as possible.		

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 11: SUSPENSION AND STEERING SYSTEM SERVICE

Objectives

Students will explain the construction, operation, and service of conventional front and rear suspension.
Students will explain the construction, operation, and service of MacPherson strut suspensions.
Students will replace MacPherson struts and conventional shock absorbers.
Students will explain the differences between conventional and rack and pinion steering system.
Students will identify the components of conventional and rack and pinion steering systems.
Students will diagnose problems in conventional and rack and pinion steering systems.
Students will service and replace steering linkage components.
Students will describe the construction, operation, and service of wheel bearings.
Students will explain tire and wheel construction and service.
Students will summarize tire size, type, and quality ratings.
Students will replace, repair, and balance tires.
Students will explain the importance of wheel alignment.
Students will summarize wheel alignment procedures.
Students will diagnose common alignment-related issues.
Students will define such terms as camber, caster, and toe-in/out.

Essential Questions

How can shock absorbers and MacPherson struts be checked for wear?
Is the vehicle alignment affected when replacing MacPherson struts?
How is access gained to the upper strut bolts?
Worn tie rod ends can cause what kind of steering system problems?
Improper wheel balancing cause what type of tire wear problems?
Why is a torque stick used when tightening an aluminum or composite wheel rim with an impact wrench?
When doing a four-wheel alignment, which alignment angle must be set last?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The MacPherson strut suspension system is used in most late-model vehicles, while many older cars and most pickup trucks have conventional suspension systems.	Replace shock absorbers on a conventional suspension system. Make a list of the tools that you needed to perform the job. Replace a MacPherson strut assembly, including removal disassembly, parts replacement, reassembly, and reinstallation on the vehicle. Write a short report, listing the tools that you	Appropriate performance on student evaluation and/or classroom participation.
Although rack and pinion steering systems are used in most late-model vehicles, many large cars		

Knowledge and Skills	Instructional Strategies	Evidence of Learning
and light trucks continue to use the conventional parallelogram linkage steering system. Proper tire inflation and alignment is critical to vehicle handling and tire wear.	needed to perform the job and explaining why the vehicle must be aligned after strut replacement. Inspect two vehicles with a conventional steering system and a rack and pinion steering system. Determine the difference between each system and write a short report explaining the differences. Inspect steering components for wear. The inspection should include all tie rod ends, idler arm, and pitman arm if used. Demonstrate the inspection procedure to other members of the class. Remove and replace a tire installed on a steel rim, on aluminum or other custom rim. List the differences between servicing a steel rim and aluminum rim. Balance a tire and wheel assembly. Explain the difference between static and dynamic balancing. Inspect at least three vehicles and determine the alignment adjustment devices. Then refer to the service manual to determine whether you found all of the adjusters. Report to the other member of your class on the things to look for when searching out alignment devices.	

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 12: PREVENTATIVE MAINTENANCE AND PROBLEM DIAGNOSIS

Objectives

Students will identify drivability.
Students will explain the differences between tune-ups and drivability diagnosis.
Students will list the basic steps for a maintenance tune-up.
Students will perform an emissions tune-up.
Students will describe the purpose of preventive maintenance.
Students will perform preventive maintenance.
Students will use a troubleshooting chart to compare a problem with its probable cause and correction.

Essential Questions

If a maintenance tune up does not solve a vehicle drivability problem, what should the technician do?
Can a non-electronic part be a source of a drivability problem?
What is a reasonable oil change interval?
What five units require a fluid level check during an oil change?
What are six possible causes for high engine oil consumption?
What are eight possible causes for engine overheating?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Drivability diagnosis is an important skill which today's mechanics must have a working knowledge of. By adhering to an appropriate preventive maintenance program the consumer can avoid future mechanical problems with his or her automobile. In many cases, even to a competent automotive technician, the problems are not always obvious, and the technician must use a problem diagnosis, or "troubleshooting" chart.	Diagnose a vehicle drivability problem using logical diagnosis procedures and one or more of the following pieces of test equipment: • Scan tool (code retrieval tool). • Multimeter. • Vacuum gauge. • Compression tester. • Oscilloscope. Perform preventive maintenance on a vehicle, which includes changing the engine oil and filter, lubricating the suspension, and checking fluid levels in the radiator, transmission, master cylinder, power steering reservoir. Also check the air filter; tire pressure, exterior lights, and other vehicle systems. Consult the diagnosis charts in a service manual to determine	Appropriate performance on student evaluation and/or classroom participation.

Knowledge and Skills	Instructional Strategies	Evidence of Learning
	the causes of high engine oil consumption. Note the order that they should be checked. Consult the diagnosis charts in a service manual to determine the causes for engine overheating. Note the order that they should be checked.	

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 13: INTRODUCTION TO AUTO BODY TECHNOLOGY

Objectives

Students will define the concepts of auto body repair.
Students will define different types of auto body repair.
Students will explain how problem solving relates to auto body repair.
Students will explain the role of the auto body person in problem solving.
Students will explain basic auto body techniques such as pulling dents, body filling, profiling/shaping, painting, and buffing.
Students will explore different careers related to auto body technology.

Essential Questions

What is the role of the auto body repair person?
What steps are taken to perform an auto body repair?
What resources must an auto body technician utilize in order to perform his job successfully?
How can auto body skills be applied to adult life?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
At some time drivers will get involved in accidents and sustain various degree of damage to their vehicle. This will require collision repair to take place. Making repairs require specific steps to be followed. Problem solving is a transferable lifelong skill. The method of the individual repair varies with the type and intensity of the accident.	Students will simulate various types of collision damage various types of material to safely make a repair of the different types of materials used in today's cars. Students will apply learned skills solving problems following the procedures for the repair process.	Appropriate performance on student evaluation and or class participation.

ADVANCED AUTO MECHANICS
GRADES 9-12

UNIT 14: CAREER OPPORTUNITIES IN THE AUTOMOTIVE FIELD

Objectives
Students will list general classes of jobs in automobile service and repair.
Students will list areas of specialization in automobile service and repair.
Students will explain job working conditions and salaries.
Students will list addresses or web sites of various organizations that offer information on automotive careers.

Essential Questions
How are most automotive technician paid?
Why is specialization-becoming commonplace in most automotive shops?
How does a person become an automotive technician?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
If you like work that is mentally and physically demanding, diversified, and financially rewarding, auto service and repair may be for you.	Go to the library and research the career opportunities for automotive technician in your area. Find the average salary for a technician in your area.	Appropriate performance on student evaluation and/or classroom participation.
Career opportunities in the automotive service industry have been very good in the past and in the future, they look even better.	Visit three or four different repair shops in your area. Note the condition of the work areas, the appearance of the technicians and other personnel, and what types of jobs were being performed. Prepare a report for the class on your findings.	

ADVANCED AUTO MECHANICS
GRADES 9-12

RESOURCES

Auto Service & Repair. M. W. Stockel, M. T. Stockel, and C. Johanson.
Computer Automotive Information Database – Mitchell On-Demand
Repair Manual – Chilton
Service Manual – Car Care Guide by Chek-Chart

PACING GUIDE

Unit	Semester 1	Semester 2
Unit 1: Safety and Environmental Protection	X	
Unit 2: Basic Tools, Equipment and Manuals	X	
Unit 3: Engine Mechanical Troubleshooting, Service and Repair	X	
Unit 4: Ignition System Service	X	
Unit 5: Fuel System Service	X	
Unit 6: Heating and Cooling System Service	X	
Unit 7: Electrical System Service	X	X
Unit 8: Exhaust, Emission, and Computer System Service		X
Unit 9: Manual, Automatic, and Transaxle Service		X
Unit 10: Brake System Service		X
Unit 11: Suspension and Steering System Service		X
Unit 12: Preventative Maintenance and Problem Diagnosis		X
Unit 13: Introduction to Auto Body Technology		X
Unit 14: Career Opportunities in the Automotive Field		X

STATE OF CONNECTICUT TECHNOLOGY EDUCATION STANDARDS

AUTOMOTIVE TECHNOLOGY (GRADES 9-12)

AUTO.01	**Students demonstrate the value and necessity of practicing personal and occupational safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards.**
AUTO.01.01	List and explain common environmental conservation practices and their applications.
AUTO.01.02	Demonstrate knowledge of proper use, storage, and disposal of hazardous materials for an automotive facility according to OSHA regulations.*(B4)
AUTO.01.03	Explain the way in which waste gasses, emissions, and other environmentally destructive substances are generated and their effects on the environment.
AUTO.01.04	Describe a safe working environment for both employees and the shop environment.
AUTO.01.05	Demonstrate and explain knowledge of personal safety practices such as eyewear, clothing, footwear, and personal protective equipment (PPE).*(B5)
AUTO.01.06	Demonstrate and explain knowledge of shop safety procedures when performing tasks, such as raising a vehicle with a floor jack.*(B6)
AUTO.01.07	Identify basic hand tools and their usage in the automotive industry.*(B7)
AUTO.02	**Customer Relations and Shop Procedures: Explain the basic processes and procedures for maintaining a clean, safe and customer-friendly shop.**
AUTO.02.01	Interpret repair and work orders including differentiating between parts and labor cost.*(A1)
AUTO.02.02	Differentiate between flat rate labor and hourly labor.*(A2)
AUTO.02.03	Explain what is included in an automobile maintenance schedule.*(A3)
AUTO.03	**Explain scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.**
AUTO.03.01	Demonstrate the operating principles of internal and external combustion engines
AUTO.03.02	Describe basic valve train operation and configuration, such as DOHC, SOHC, OHV, and flathead.*(C8)
AUTO.03.03	Describe basic engine cylinder configurations such as V, inline, and horizontally opposed.*(C9)
AUTO.03.04	Identify and describe the function of the basic engine components.*(C10)
AUTO.03.05	Describe principles of pneumatic and hydraulic power and their applications.
AUTO.03.06	Describe the purpose, operation, and basic components of lubrication systems.*(C13)
	Describe the purpose, operation, and basic components of engine cooling systems.*(C14)
AUTO.03.07	Illustrate principles of electricity, electronics and electrical power generation, and distribution systems.
AUTO.03.08	Differentiate between the 4-stroke and 2-stroke operating cycles.*(C11)

AUTO.03.09	Differentiate between spark ignition and compression ignition engines.*(C12)
AUTO.03.10	Perform necessary procedures to maintain, diagnose, service, and repair vehicle systems and malfunctions.
AUTO.04	**Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.**
AUTO.04.01	Follow the procedures and practices of various manufacturers regarding repair and maintenance schedules.
AUTO.04.02	Demonstrate how to properly document maintenance procedures in accordance with applicable rules, laws, and regulations.
AUTO.04.03	Use reference books, technical service bulletins, and other documents and materials related to the automotive service industry available in print and through electronic retrieval systems to accurately diagnose and repair vehicles.
AUTO.04.04	Evaluate the advantages and disadvantages of existing, new, and emerging systems and the effects of those systems on the environment.
AUTO.04.05	Complete a work order, including customer information, description of repairs, and billing information, in accordance with applicable rules, laws, and regulations.
AUTO.05	**Diagnosis and repair engines, including but not limited to two- and four-stroke and supporting subsystems**
AUTO.05.01	Perform general engine maintenance, diagnosis, service, and repair in accordance with portable national industry standards.
AUTO.05.02	Maintain, diagnose, service, and repair lubrication and cooling systems.
AUTO.05.03	Maintain, diagnose, and repair computerized engine control systems and other engine-related systems.
AUTO.05.04	Describe and demonstrate the process for performing exhaust inspection and service.
AUTO.06	**Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.**
AUTO.06.01	Maintain, diagnose, and repair electrical systems.
AUTO.06.02	Explain the process for performing battery diagnosis and service.*(D16)
AUTO.06.03	Describe the purpose, operation, and components of basic starting systems.*(D17)
AUTO.06.04	Describe the purpose, operation, and components of basic charging systems.*(D18)
AUTO.06.05	Describe the purpose, operation, and components of basic lighting systems.*(D19)
AUTO.06.06	Differentiate between series and parallel circuits.*(D20)
AUTO.06.07	Define volts, amperes, and resistance.*(D21)
AUTO.06.08	Perform simple calculations for volts, amperes, and resistance using Ohm's Law.*(D22)
AUTO.07	**Engine Performance: Describe the components and functions of the various systems that are related to engine performance.**
AUTO.07.01	Describe the purpose, operation, and basic components of the ignition system.*(E23)
AUTO.07.02	Describe the purpose, operation, and basic components of fuel and air induction systems.*(E24)

AUTO.07.03 Describe the purpose, operation, and basic components of exhaust and exhaust emissions systems.*(C15)

AUTO.07.04 Explain the use of a computer scanner to read Diagnostic Trouble Codes (DTC).*(E27)

AUTO.07.05 Identify the differences between carburetion and fuel injection.*(E25)

AUTO.07.06 Describe the purpose, operation, and basic components of evaporative emission control systems.*(E26)

AUTO.08 Suspension and Steering: Identify and describe the function of the components that make up suspension and steering systems.

AUTO.08.01 Describe the purpose, operation, and basic components of the steering system.*(F28)

AUTO.08.02 Describe the purpose, operation, and basic components of the suspension system.*(F29)

AUTO.08.03 Explain caster, camber, and toe-in wheel alignment angles.*(F30)

AUTO.08.04 Identify factors that cause abnormal tire wear.*(E31)

AUTO.09 Demonstrate function and principles of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with portable national industry standards.

AUTO.09.01 Explain hydraulic systems as they pertain to the service braking systems.*(G32)

AUTO.09.02 Describe the purpose, operation, and basic components of drum brakes.*(G33)

AUTO.09.03 Describe the purpose, operation, and basic components of disc brakes.*(G34)

AUTO.09.04 Describe the components of power assist braking systems.

AUTO.09.05 Describe the purpose, operation, and basic components of parking brake systems.*(G35)

AUTO.09.06 Describe the purpose, operation, and basic components of anti-lock braking systems (ABS) and traction control systems (TCS).*(G36)

AUTO.09.07 Describe the function and operation of automatic and manual transmissions and transaxles.

AUTO.09.08 Select appropriate wheels and tires for vehicles.

AUTO.09.09 Maintain, diagnose, service, and repair under-vehicle systems and malfunctions.

AUTO.10 Explain collision repair scientific principles in relation to chemical, mechanical, and physical functions and in relation to industry and manufacturer standards

AUTO.10.01 Diagram principles of mechanical, electrical, hydraulic, and pneumatic power in relation to collision repair and refinishing

AUTO.10.02 Analyze physical and chemical characteristics of metals, plastics, and other materials.

AUTO.10.03 Describe various body and frame construction types.

AUTO.11 Perform and document collision repair procedures in accordance with manufacturer recommendations and industry standards.

AUTO.11.01 Perform collision repairs according to recommended procedures and practices of various manufacturers.

AUTO.11.02 Use reference books and materials, technical service bulletins, and other related documents to determine repairs and rate of pay.

AUTO.11.03 Perform frame inspection and repair.

AUTO.11.04 Demonstrate applications, installations, and removal of fixed and moveable glass and hardware.

AUTO.11.05 Perform metal welding and cutting.

AUTO.11.06 Prepare and analyze vehicles for repair.

AUTO.11.07 Perform outer body panel repairs, replacements, and adjustments.

AUTO.11.08 Prepare vehicles for metal finishing and body filling.

AUTO.12 Painting and refinish vehicles in accordance with manufacturer recommendations and industry standards.

AUTO.12.01 Identify, use, and repair plastics and adhesives

AUTO.12.02 Prepare surfaces for painting and finishing

AUTO.12.03 Operate of spray guns and related equipment.

AUTO.12.04 Mix, match, and apply paint.

AUTO.12.05 Diagnose causes and apply cures of paint defects.

AUTO.12.06 Prepare vehicles for final detail.

GRAPHIC COMMUNICATIONS
GRADES 9-12

In this course, students will be exposed to the two realms of graphic communication. To begin with, the student will learn silk screen printing, which is a very popular and fun method of printing that can be used to produce such products as tee shirts and greeting cards. Next, the student will learn methods of desktop publishing, covering design and layout of printed pages with a variety of text and graphics. Projects may include printing sample advertisements, business cards, etc.

Credit: 0.5

GRAPHIC COMMUNICATIONS
GRADES 9-12

UNIT 1: ELEMENTS OF DESIGN

Objectives

Students will discuss developments and individuals related to the history of graphic design industry and explore emerging trends and technologies.
Students will explore careers available in the field of graphic communications and the graphic design industries.
Students will examine the professional and ethical issues involved in the graphic design industries.
Students will employ basic elements of graphic design to create individual graphic work projects.
Students will employ an engineering approach to problem solving called the technology systems model.
Students will identify and apply the principles of design to layout.
Students will identify and apply the design process.

Essential Questions

What basic elements of design should be considered when creating a graphic work product?
What are the basic elements of graphic design?
What is the design process?
What does a graphic designer do?
How can the technology systems model be used to solve any problem in life?
What are the only two reasons for failure?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
When designing a graphic workpiece basic elements of design should be employed.	Students will create multiple graphic designs throughout the course through which their basic elements of design will be employed.	Appropriate performance on student evaluation and/or classroom participation.
The design process should be employed when laying out a graphic design.		

GRAPHIC COMMUNICATIONS
GRADES 9-12

UNIT 2: PAPER CUTTING

Objectives
Students will outline the steps required to set up the power paper cutter.
Students will demonstrate a respect for the rules for safe operation of the power paper cutter.

Essential Questions
What is the most important safety rule for operating the power paper cutter?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Using machines to perform repetitive tasks can be accomplished quickly with very little effort.	Employing a power paper cutter to cut paper to a desired size.	Appropriate performance on student evaluation and/or classroom participation.
Using the technology systems model to solve problems leads to success.		

GRAPHIC COMMUNICATIONS
GRADES 9-12

UNIT 3: DESKTOP PUBLISHING

Objectives
Students will demonstrate the use of a desktop publishing program by creating simple documents.

Essential Questions
What is the major function of a desktop publishing program?
When developing text to be used with desktop publishing programs what type of software program should be used?
What three publishing tasks are combined by using desktop publishing?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Quality work can now be produced on a personal computer.	Use a software tutorial to become familiar with the operations and functions of a desktop publishing program.	Appropriate performance on student evaluation and/or classroom participation.
Before purchasing a desk top publishing program many factors should be considered.	Prepare various documents using a desktop publishing system.	

GRAPHIC COMMUNICATIONS
GRADES 9-12

UNIT 4: SILK SCREEN PRINTING THEORY

Objectives

Students will explain that silk screen printing is accomplished by forcing ink through openings or holes in a stencil.
Students will discuss the versatility of this process as to size, texture, and shape of the object to be printed.
Students will compare the cost of this process in place of other printing processes.
Students will identify a variety of products that were commercially printed with this process.
Students will explain a variety of safety concerns related to silk screen printing as well as everyday living.

Essential Questions

How do we identify a product that is printed with the screen process?
What factors determine if it is practical to use the screen process to print a particular product?
How does the cost of equipment for screen printing compare to the cost of equipment for other types of printing?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Many methods of printing exist due to the vast array of printed products that exist today.	Collect samples of different products that were produced by using the silk screen printing process. Discuss with the class how these products were printed with the screen process.	Appropriate performance on student evaluation and/or classroom participation.
Due to equipment needs there may be a significant difference in the cost of establishing facilities for different printing methods.		
A concern for safety transcends all phases of daily living.		

GRAPHIC COMMUNICATIONS
GRADES 9-12

UNIT 5: SILK SCREEN PRINTING TECHNIQUES

Objectives

Students will select an appropriate size frame and do all the required steps to make the screen ready to use.
Students will demonstrate the proper selection, cutting, and adhering of a stencil.
Students will outline the proper steps to block out around a stencil.
Students will demonstrate the proper use of ink and a squeegee to produce a printed copy.
Students will summarize the process for removing the ink from the screen without damaging the stencil.
Students will explain the process to remove the block out and stencil from a screen.
Students will state the importance of proper use of register marks when creating a multicolor project.
Students will demonstrate an ability to print on a variety of materials such as; metal, plastic, wood, and fabric.
Students will list the steps required to produce a project using a photo stencil.

Essential Questions

What is the difference between a registration mark and a guide?
How do we attach the various stencils to the screen?
How do we know when a stencil is ready for printing?
After printing what indicates that a screen is clean and ready to be used at another time?
Why is it important to maintain a neat and orderly work area?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Silk screening is a printing technique that can be used on many different materials.	Print a two or more color silk screen design on paper. Using a photo stencil print a one color design on fabric (example- shirt).	Appropriate performance on student evaluation and/or classroom participation.
The quality of the final product is related to the effort put into each step required to produce it.		
Working neatly will save clean up time and effort.		

GRAPHIC COMMUNICATIONS
GRADES 9-12

UNIT 6: SILK SCREEN PRINTING MATERIALS

Objectives

Students will identify characteristics of silk screen fabric and how the fabric mesh relates to the appropriate selection for a specific job.
Students will list a variety of materials that can be used for making stencils.
Students will identify a piece of silk screen stencil film and explain the function of each of its layers.
Students will describe the purpose of block out materials.
Students will identify silk screen inks according to their base.
Students will discuss the compatibility of stencils, block out, and ink to each other as they relate to a particular job.
Students will recognize the need for specific types of solvents for removing various types of ink bases, and stencils from the screen.

Essential Questions

Why does screen fabric come in many different mesh sizes?
When preparing a hand-cut film stencil, which layer is cut through and removed?
What solvent is used to remove oil based ink?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
There may be more than one type of stencil that can be used to print the same product.	Cut a set of stencils of your initials using silk screen stencil film.	Appropriate performance on student evaluation and/or classroom participation.
Care must be taken in the selection of materials so as not to have adverse reactions among the materials being used.		

GRAPHIC COMMUNICATIONS
GRADES 9-12

UNIT 7: SILK SCREEN PRINTING EQUIPMENT

Objectives
Students will demonstrate how to properly stretch and staple silk to a silk screen frame.
Students will explain the need for different size frames and squeegees.
Students will list related tools that may be needed before this process is completed.

Essential Questions
When is it necessary to attach a new fabric to a screen printing frame?
How is a new fabric attached to a frame so that it is tight and wrinkle free?
How is a screen print made?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Certain screen printing equipment such as frames and squeegees do not always have to be purchased.	Students will each demonstrate a different way to make a screen printing frame. Prepare your own screen process printing frame so that it will accept your first stencil.	Appropriate performance on student evaluation and/or classroom participation.
Silk screen printing can be done in facilities that range from large commercial establishments to small at home shops.		

GRAPHIC COMMUNICATIONS
GRADES 9-12

UNIT 8: GRAPHIC ANIMATION

Objectives
Students will create an animation by means of free online Blenders software.
Students will create a computer game employing the animation they created.
Students will be made aware of career opportunities in the field of computer animation.
Essential Questions
What is computer animation?
How can the computer be used as a tool to teach yourself anything you want to know?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Computer animation is an upcoming field with great career potential. The computer can be used as a powerful tool to teach yourself anything you want to know.	Students will create a computer animated figure through the use of Blender software and insert it into a game of their making.	Appropriate performance on student evaluation and/or classroom participation.

GRAPHIC COMMUNICATIONS CLASS RUBRIC

GRAPHIC COMMUNICATIONS
GRADES 9-12

	4 Exceptional	3 Proficient	2 Minimal	1 inadequate	Score
Communicate in Standard English	Student demonstrates high skill in following direction, providing verbal discourse, and writing lab reports.	Student demonstrates average skills in following direction, providing verbal discourse, and/or writing lab reports.	Student demonstrates little skill in following direction, providing verbal discourse, and/or writing lab reports.	Little attempt at communication was evident, and/or lab report was not completed.	
Read and understand a variety of materials	Always reads a variety of materials for a complete understanding of the task at hand.	Reads a variety of materials related to the task at hand.	Most of the time, material is read for the task at hand.	Seldom reads any material for the task at hand.	
Apply mathematical principles to solve and justify problems	Student demonstrates high skill in problem comprehension, problem application, and accurate evaluation of the problem.	Student demonstrates average skills in problem comprehension, problem application, and/or accurate evaluation of the problem.	Student demonstrates little skill in problem comprehension, problem application, and/or accurate evaluation of the problem.	Little attempt at a mathematical solution to problem is attempted or comprehended.	
Evaluate information to interpret events and make informed responses	The student develops and demonstrates a planned logical clear and well thought out approach to the solution of a complex task or problem.	The student develops and demonstrates a planned logical approach but must modify the methods and process to complete the task or problem.	The student develops an approach but lacks clarity and evidence of planning.	The approach taken by the student is disorganized, unclear, and haphazard with no logical sequence.	
Apply scientific principles to solve problems	Student effectively, logically, and appropriately incorporates the principles of science to solve problems.	Student incorporates the principles of science to solve problems.	Student attempts to incorporate the principles of science to solve problems.	No attempt is made to incorporate the principles of science to the problem at hand.	
Utilizes technology to organize and solve problems	The student always chooses the appropriate technology to successfully accomplish a task.	The student demonstrates the use of some appropriate technologies including various tools to successfully accomplish a task or solution.	The student demonstrates limited use of technologies to successfully accomplish a task or solution.	The student rarely demonstrates the use of technologies when solving problems or tasks.	

RESOURCES

GRAPHIC COMMUNICATIONS
GRADES 9-12

Graphic Communications, Prust, Zeke. The Printed Image, South Holland, Illinois.

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: Elements of Design	X	
Unit 2: Paper Cutting	X	
Unit 3: Desktop Publishing	X	
Unit 4: Silk Screen Printing Theory	X	
Unit 5: Silk Screen Printing Techniques		X
Unit 6: Silk Screen Printing Materials		X
Unit 7: Silk Screen Printing Equipment		X
Unit 8: Graphic Animation		X

INTRODUCTION TO WEBSITE DEVELOPMENT
GRADES 9-12

This is a project-based course designed to teach students skills in web design. This includes planning, construction, deployment, and maintenance of a webpage. Students will learn to use a variety of hardware and software to create, maintain, and update web pages. This will include the use of computers, scanners, digital cameras, web authoring software, imaging and graphic design software. Students will work in collaboration with one another to explore solutions to problems, share their skills, and discover new and innovative approaches to unique challenges.

Credit: 0.5

INTRODUCTION TO WEBSITE DEVELOPMENT
GRADES 9-12

UNIT 1: THE HISTORY OF THE INTERNET

Objectives

Students will explain the historical innovations in the evolution of communications systems and the internet.
Students will identify, analyze and synthesize historical, social, economic, environmental, and government regulations impact on Communications technology from multiple authoritative sources.
Students will gather relevant information from multiple authoritative print, digital resources, using advanced researches, to predict the social, economic and environmental impacts of existing and evolving communication technologies.
Students will identify key factors that have impacted the evolution of the communications technologies.
Students will identify legal implications of misuse of the Internet.
Students will describe the school technology/computer use policy.
Students will describe the function of a web browser.
Students will explain how browsers find information on the internet.

Essential Questions

What is the history of the internet?
What are the Copyright Responsibilities of Internet Use?
Why was the Internet developed?
What is, and how can you protect yourself from computer hacking and cyber-crime?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The internet was developed to share information amongst its users.	Explore sample internet use policies. Discuss similarities and differences between various internet use forms. Develop own internet use policy. Research history of the internet.	Appropriate performance on student evaluation and/or classroom participation.
People use the internet at their own risk.		
There is copyrighted information on the internet, which cannot be used without permission of the copyright holder.		

INTRODUCTION TO WEBSITE DEVELOPMENT
GRADES 9-12

UNIT 2: WEB PAGE LAYOUT AND DESIGN (Dreamweaver from the Adobe CS6 suite)

Objectives

Students will use storyboarding to set up the flow of a website.
Students will use the software tools to demonstrate an understanding of the software applications used. (e.g. Dreamweaver and online resources).
Students will define and utilize communications technology systems domain specific words and phrases.
Students will define and properly use common website and internet terminology.
Students will read, interpret and utilize media communication equipment instruction manuals, troubleshooting guides, and specification requirements.
Students will demonstrate an understanding of design elements and applications of design principles when developing projects.
Students will organize web sites and effectively use text, images and links.

Essential Questions

What is the role of the web page designer?
What are the basic elements and principles of design?
What is a storyboard when used with web design?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Specialized software packages are used in creating and editing Web pages.	In this unit, students create the elements of web pages with Adobe Dreamweaver. They will build web sites that features required design principles for the work to be completed. As they create their web pages, students will plan, implement, and test their web site design. Students will evaluate their work for quality layout and design.	Appropriate performance on student evaluation and/or classroom participation.
Web pages are planned and evaluated so that they meet a particular need for a client.		
Web sites can be created, modified, and optimized by the web designer.		
Principles of design are used to plan projects and to incorporate solutions into subsequent projects.		

INTRODUCTION TO WEBSITE DEVELOPMENT
GRADES 9-12

UNIT 3: IMAGE EDITING (FIREWORKS and/or PHOTOSHOP Program from Adobe CS6)

Objectives

Students will effectively use Fireworks and/or Photoshop program in the Adobe CS6 suite to edit images for use in a web page.
Students will set up a web page and effectively use images and buttons for links.
Students will apply proper formatting for importing and exporting image files.
Students will use appropriate design elements of a web page.
Students will test image attributes and adjust and edit as needed.

Essential Questions

What ways can an image be manipulated?
What steps are involved in image modification?
What processes are involved in image modification?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Images are used to enhance the material used in a web page.	Complete an image manipulation by copying parts of an image. Use file formats for images: e.g., .gif, .jpg, and .png. Import images into the computer from the internet to a file. Planning and designing graphics for use in a web page. Apply design principles when creating images and logos. Brainstorming and create ideas for banners and pamphlets.	Appropriate performance on student evaluation and/or classroom participation.
Designers use various software packages to modify images for webpages.		
The presentation of an electronic image can be just as important as its content.		

INTRODUCTION TO WEBSITE DEVELOPMENT
GRADES 9-12

UNIT 4: ANIMATION IN WEB PAGES (FLASH Program from Adobe CS6)

Objectives
Students will build a Flash animation that uses tweening.
Students will create a Flash animation for images.
Students will work with images, text and thumbnails in Flash.
Students will link Flash animations to web pages.

Essential Questions
What is Flash animation?
How can you incorporate a Flash animation in a web design?
How can you build a Flash animation?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Flash animation is used to animate information in a web page. Various design workers within a web design business are responsible for individual tasks such as Flash animation. Flash animation can be used by individuals and corporations as a way to display key ideas.	Create basic tweening projects using Flash. Choose tweening projects to create a web site header. Create a Flash tween poster of your best idea and evaluate it. Consider combining Flash tween activities into one webpage. Re-evaluate and consider ways to modify your design if necessary. Prepare to present your ideas to the class.	Appropriate performance on student evaluation and/or classroom participation.

INTRODUCTION TO WEBSITE DEVELOPMENT
GRADES 9-12

UNIT 5: BUILDING A WEB PAGE WITH A TABLE

Objectives

Students will define a layout table design for a web site project.
Students will plan a table design for a project.
Students will structure a table design web site.
Students will design a table design web site.
Students will build a table design web site.
Students will test a table design web site.

Essential Questions

Why is a table design used to build a web page?
What does the table design communicate between the web designer and the client?
What part does storyboarding play in designing a table design website?
How is testing the web site useful when designing a table design web site?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The table layout portrays: the style, and recurring information, as well as the type of information included in the website. The table layout is used to understand the designer's intent for the website. There is a need to evaluate the strengths of the design in table design layout.	Project Management Skills • Designing a table style website • Developing a project storyboard Design Skills • Creating designs that meet table design requirements • Making simple storyboards to convey ideas • Providing multiple design ideas • Use the design process • Creating various table design ideas • Finalizing design in the design process Technical Skills (Macromedia Dreamweaver) • Using table design • Creating links • Checking links	Appropriate performance on student evaluation and/or classroom participation.

INTRODUCTION TO WEBSITE DEVELOPMENT
GRADES 9-12

UNIT 6: WEB SITE FOR A CLIENT

Objectives
Students will create a table design for the site.
Students will create the redesign components of the home page.
Students will create the redesign components of the content page.
Students will make a class presentation on using technical skills in Adobe cs6 Dreamweaver, Flash and Fireworks or Photoshop.

Essential Questions
What client background information is needed to build a client web page?
Why is communication important between the web designer and the client?
Why is there a need to storyboard a client web site?
Why do client web sites need to be reviewed and revised during the design process?
How is testing the web site beneficial to the designing process of a client web site?
Why are libraries used when designing a web site?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The client's needs dictate the topic of the site and specifies the content to be included on the site.	Analyze the client's site and identify three or four major design challenges.	Appropriate performance on student evaluation and/or classroom participation.
The web designer interprets the client's needs in designing the navigation, the look and the feel, and the content flow.	Write a design document.	
The client determines which site design most closely meets their needs.	Present a design document to a client.	
	Respond constructively to client feedback.	
	Make necessary changes to a design document, based on client feedback.	
	Build a Web page layout based on a design document.	
	Design a Dreamweaver document as a Dreamweaver template, using linked sheets.	

INTRODUCTION TO WEBSITE DEVELOPMENT
GRADES 9-12

WEB SITE DESIGN PROJECT RUBRIC

Student Name: _____ Date: _____

Web Project: _____ Due: _____

Score	0-5 pts.	6-10 pts.	11-15 pts.	16-20 pts.	Your Score
Development of Storyboard/plan	Not completed or sloppily presented.	Many parts missing, some sections not presentable.	Some parts missing, could improve for presentation.	Complete, neat, professional presentation.	
Follows storyboard and plan to produce project.	Did not follow storyboard.	Followed some of storyboard, but dismisses other parts to produce required outcome.	Most of the time, but had some problems with all directions.	Always, follows precise directions, is able to solve project problems.	
On Task; proper use of class time.	Wastes class time, constantly talking to others often, off task.	Not using time effectively, strays to unrelated topics.	Usually on task but talks to others occasionally.	Works full class periods.	
Timeliness; completes project on time.	Three or more days late.	Two days late.	One day late.	Met original date and time.	
Presentation/Grammar	Multiple grammatical and stylistic errors.	Some errors in grammar and/or stylistic errors.	Few grammatical and/or stylistic errors	Nearly error free and reflects a clear understanding of design principles.	

Total Score: _____

Final Grade = Total Score

Final Grade: _____

INTRODUCTION TO WEBSITE DEVELOPMENT
GRADES 9-12

RESOURCES

Macromedia Studio MX, Aho, Kirsti. 2004. Thompson Course Technology, Boston, MA.
Dreamweaver
Fireworks
Flash

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: The Internet Basics	X	
Unit 2: Web Page Layout and Design (Dreamweaver)	X	
Unit 3: Image Editing (Fireworks and/or Photoshop)	X	
Unit 4: Animation in Web Pages (Flash)		X
Unit 5: Building a Web Page with a Template		X
Unit 6: Web Site for a Client		X

ADVANCED WEB SITE DESIGN
GRADES 10-12

The first semester develops skills that lay the foundations for producing web-ready communications: graphic design principles, storyboards, development, peer review, and redesign. Project activities focus on developing effective personal communications. Students develop a variety of graphical images, an electronic portfolio, a web photo album, and interactive graphics. There is a great deal of flexibility implied in the curriculum.

The second semester builds on student design and development skills by shifting perspective from the personal to the local. Students now work in teams and product web communications for clients. The focus is on effective teamwork and shared project management skills, such as interviewing and project scheduling. They product design documents and visual comps that clients review, develop web site designs that solve specific communication challenges, and build technical skills to address client needs for their web sites.

Prerequisite: Intro to Web Page Development

Credit: 1.0

ADVANCED WEB SITE DESIGN
GRADES 10-12

UNIT 1: INTRODUCTION TO THE INTERNET

Objectives

Students will identify legal implications of misuse of the Internet.

Students will identify, analyze and synthesize historical, social, economic, environmental, and government regulations impact on communications technology from multiple authoritative sources.

Students will describe the school, district or state AUP.

Students will describe a web browser's function.

Students will explain how pages are found on the Web.

Students will describe the inception of the Internet.

Students will list and explain historical innovations in the evolution of communications systems.

Students will gather relevant information from multiple authoritative print, digital resources, using advanced researches, to predict the social, economic and environmental impacts of existing and evolving communication technologies.

Students will identify key factors that have impacted the evolution of the communications technologies.

Students will explain how governmental regulations impact communications.

Essential Questions

Why is there a need for an Acceptable Use Policy (AUP) when using the Internet at school?
What are the Ethical Responsibilities of Internet Use?
Why was the Internet developed?
What are the implications of cyber-crimes and computer hacking?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The internet is a vast and powerful tool used to gather and dispense information. For the most part the internet is unregulated and may contain information that is not always presented with the safety of the user coming first. There is copyrighted information on the internet, which cannot be used without permission of the copyright holder.	Explore sample AUP's. Discuss similarities and differences. Develop own AUP. Research history of the internet. Identify components of a web browser. Identify activities of cyber criminals and hackers.	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED WEB SITE DESIGN
GRADES 10-12

UNIT 2: GRAPHIC DESIGN

Objectives

Students will use storyboarding to plan webpage production from start to finish.
Students will use the software tools to demonstrate an understanding of the software applications used.
Students will define and utilize communications technology systems domain specific words and phrases in their designs.
Students will define and properly use common communication terminology.
Students will read, interpret and utilize media communication equipment instruction manuals, troubleshooting guides, and specification requirements.
Students will demonstrate an understanding of design elements and applications of design principles when developing projects.
Students will consistently apply naming conventions to files and folders.

Essential Questions

What is the role of the web graphic designer?
What are the elements and principles of design?
How is a message design developed?
What is a storyboard?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Various software packages are used in image editing program designed to create images, effects, and optimization especially for web pages. Web graphics are planned and evaluated so the images they produce meet a particular need. Digital images can be created, modified, and optimized by the web designer. Principles of design are used to evaluate projects and reflection is used to incorporate solutions into subsequent projects.	Complete Internet Research Explore file types for graphics: .gif, .jpg, and .png. Identify copyrighted material within a website. Importing images into the computer from scanner and digital camera. Planning and designing graphics for use on the internet. Optimizing images for internet use. Apply design elements, including composition, balance, unity, contrast, emphasis, line and color. Brainstorm and propose appropriate naming conventions for files and folders.	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED WEB SITE DESIGN
GRADES 10-12

UNIT 3: ELECTRONIC PORTFOLIOS

Objectives

Students will effectively use Dreamweaver to set up a local root folder and a local site.
Students will set up a web page and effectively use text, images and links.
Students will apply proper conventions when naming files.
Students will analyze and address all design elements of a web page.
Students will test web site and repair as needed.

Essential Questions

What jobs are available in graphic communications?
What steps are involved in pre-production?
What steps are involved in the production process?
What processes are involved in post-production?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Portfolios communicate accomplishments, works in progress, or personal history.	In this unit, students create the elements of an electronic portfolio with Macromedia Dreamweaver. They build a Web site that features work they have completed and work to be completed. As they create their portfolios, students plan, implement, and test their Web site design; students then reflect on and evaluate their work. Incorporating graphic design techniques is essential in this unit.	Appropriate performance on student evaluation and/or classroom participation.
Designers use a portfolio to showcase their previous work when applying for a job.		
With the Internet, portfolios can be electronic, easily and quickly sharing a designer's work with anyone in the world.		
The presentation of an electronic portfolio can be just as important as its content.		

ADVANCED WEB SITE DESIGN
GRADES 10-12

UNIT 4: BUILDING A WEB PAGE WITH A TEMPLATE

Objectives

Students will define a template web site project.
Students will plan a template project.
Students will structure a template web site.
Students will design a template web site.
Students will build a template web site.
Students will test a template web site.

Essential Questions

Why is a template used to build a web page?
What does the template communicate between the web designer and the client?
What part does storyboarding play in designing a template website?
What happens to a website if a template needs to be changed?
How is testing the web site useful when designing a template web site?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The template portrays: the style, and recurring information, as well as the type of information included in the website. The template is used to understand the designer's intent for the website. There is a need to evaluate the strengths of the design in template layout.	Project Management Skills • Designing a template style website • Developing a project storyboard Design Skills • Creating designs that meet template requirements • Making simple storyboards to convey ideas • Providing multiple design ideas • Use the design process • Creating various template ideas • Finalizing design in the design process Technical Skills (Macromedia Dreamweaver) • Using templates • Creating links • Checking links	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED WEB SITE DESIGN
GRADES 10-12

UNIT 5: INTERACTIVE DESIGN WITH ADOBE CS6 - FIREWORKS

Objectives

Students will identify a variety of methods and reasons for organizing and displaying information.
Students will view and analyze visual information design on the Web.
Students will create a presentation and report on visual information.
Students will understand the uses of frames, layers, and behaviors in Fireworks and/or Photoshop.
Students will plan an interactive image.
Students will produce a storyboard for an interactive image.
Students will use a storyboard to create an interactive image.
Students will create simple and disjoint rollover images.
Students will link image slices to other Web pages.
Students will export an interactive image from Macromedia Fireworks and/or Photoshop as an HTML document.

Essential Questions

What is an interactive image?
Why are interactive images uses in the development of web pages?
Why is there a need to storyboard interactive images?
What advantages are gained by integrating interactive components into a web site?
How can Fireworks MX be used to create interactive images?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The graphic design of an image conveys one level of information, while interactivity presents another level of information. Graphic design principles, information design, and software packages are used to create an interactive image. Interactivity is an important tool for creating usable and appealing Web sites.	Project Management Skill • Planning an interactive image • Evaluating and integrating interactive components into a Web site Design Skills • Creating storyboards for interactive components • Analyzing images as a means of information display Research and Communication Skills • Investigating the structure and visual information design of images • Evaluating the effectiveness and appropriateness of	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED WEB SITE DESIGN
GRADES 10-12

Knowledge and Skills	Instructional Strategies	Evidence of Learning
	interactive images Technical Skills (Macromedia Dreamweaver in Adobe CS6) • Importing interactive images Technical Skills (Macromedia Fireworks and/or Photoshop in Adobe CS6) • Using layers, frames, and behaviors • Working with bitmap images • Creating disjoint and simple rollover images • Troubleshooting interactive images	

ADVANCED WEB SITE DESIGN
GRADES 10-12

UNIT 6: BUILDING A CLIENT WEB PAGE

Objectives

Students will define a client web site project.
Students will plan a client project.
Students will structure a client web site.
Students will design a client web site.
Students will review and revise to client specifications.
Students will build a client web site.
Students will test and launch a client web site.

Essential Questions

What client background information is needed to build a client web page?
Why is communication important between the web designer and the client?
Why is there a need to storyboard a client web site?
Why do client web sites need to be reviewed and revised during the design process?
How is testing the web site beneficial to the designing process of a client web site?
Why are libraries used when designing a web site?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The website portrays to the audience; the purpose, and goals, as well as the type of information included in the website. There is a need to understand the designer's intent for the website. There is a need to evaluate the strengths of the design in client web page.	Project Management Skill • Designing for a client rather than yourself • Developing a project plan Design Skills • Creating designs that meet client requirements • Making simple screen views to convey ideas • Providing multiple design ideas • Designing to others' requirements • Participating in design review meetings • Creating design comps' Research and Communication Skills • Asking questions to focus and clarify • Communicating ideas clearly	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED WEB SITE DESIGN
GRADES 10-12

Knowledge and Skills	Instructional Strategies	Evidence of Learning
	• Listening and interpreting information and feedback • Finalizing design with the client Technical Skills (Macromedia Dreamweaver) • Using templates • Using libraries • Checking files in and out	

ADVANCED WEB SITE DESIGN
GRADES 10-12

UNIT 7: REDESIGNING A CLIENT WEB SITE

Objectives
Students will create a template for the site.
Students will create the redesign components of the home page.
Students will create the redesign components of the content page.
Students will make a class presentation on using technical skills in Dreamweaver and Fireworks and/or Photoshop.

Essential Questions
What client background information is needed to build a client web page?
Why is communication important between the web designer and the client?
Why is there a need to storyboard a client web site?
Why do client web sites need to be reviewed and revised during the design process?
How is testing the web site beneficial to the designing process of a client web site?
Why are libraries used when designing a web site?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The client's needs dictate the topic of the site and specifies the content to be included on the site. The web designer interprets the client's needs in designing the navigation, the look and the feel, and the content flow. The client determines which site design most closely meets their needs.	Analyze the client's site and identify three or four major design challenges. Write a design document. Present a design document to a client. Respond constructively to client feedback. Make necessary changes to a design document, based on client feedback. Build a Web page layout based on a design document. Design a Dreamweaver document as a Dreamweaver template, using Cascading Style Sheets. Create various technical features, as required (calendars, forms, image maps, rollover images, tables from imported spreadsheets, pop-up menus, preparation of photographs, and animated images).	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED WEB SITE DESIGN
GRADES 10-12

ADVANCED WEB SITE DESIGN PROJECT RUBRIC

Student Name: _____ Date: _____

Web Project: _____ Due: _____

Score	0-5 pts.	6-10 pts.	11-15 pts.	16-20 pts.	Your Score
Development of Storyboard/plan	Not completed or sloppily presented.	Many parts missing, some sections not presentable.	Some parts missing, could improve for presentation.	Complete, neat, professional presentation.	
Follows storyboard and plan to produce project.	Did not follow storyboard.	Followed some of storyboard, but dismisses other parts to produce required outcome.	Most of the time, but had some problems with all directions.	Always, follows precise directions, is able to solve project problems.	
On Task; proper use of class time.	Wastes class time, constantly talking to others often, off task.	Not using time effectively, strays to unrelated topics.	Usually on task but talks to others occasionally.	Works full class periods.	
Timeliness; completes project on time.	Three or more days late.	Two days late.	One day late.	Met original date and time.	
Presentation/Grammar	Multiple grammatical and stylistic errors.	Some errors in grammar and/or stylistic errors.	Few grammatical and/or stylistic errors	Nearly error free and reflects a clear understanding of design principles.	

Total Score: _____

Final Grade = Total Score

Final Grade: _____

ADVANCED WEB SITE DESIGN
GRADES 10-12

RESOURCES

Digital Design, Aho, Kirsti, Dharkar, Anuja and Miller, Gloria. 2003. Thompson Course Technology, Boston, MA.
Dreamweaver
Fireworks
Flash

PACING GUIDE

Unit	Semester 1	Semester 2
Unit 1: Introduction to the Internet	X	
Unit 2: Graphic Design	X	
Unit 3: Electronic Portfolios	X	
Unit 4: Building a Web Page with a Template	X	X
Unit 5: Interactive Design with Adobe Fireworks and/or Photoshop		X
Unit 6: Building a Client Web Page		X
Unit 7: Redesigning a Client Web Site		X

STATE OF CONNECTICUT TECHNOLOGY EDUCATIONS STANDARDS

COMMUNICATIONS (GRADES 9-12)

AVC.01	**Identify, analyze and synthesize historical, social, economic, environmental, and government regulations impact on Communications technology from multiple authoritative sources.**
AVC.01.01	List and explain historical innovations in the evolution of communications systems.
AVC.01.02	Gather relevant information from multiple authoritative print, digital resources, using advanced researches, to Predict the social, economic and environmental impacts of existing and evolving communication technologies.
AVC.01.03	Identify key factors that have impacted the evolution of the communications technologies.
AVC.01.04	Explain how governmental regulations impact communications.
AVC.02	**Define and utilize communications technology systems domain specific words and phrases.**
AVC.02.01	Define and properly use common communication terminology.
AVC.02.02	Read, interpret and utilize media communication equipment instruction manuals, troubleshooting guides, and specification requirements.
AVC.03	**Demonstrate the use of appropriate communication equipment for the delivery of a message.**
AVC.03.01	Select equipment required for specific types of audio productions.
AVC.03.02	Describe how an audio mixing console, quality-monitoring equipment, and basic recording equipment are utilized.
AVC.03.03	Demonstrate how to record and mix audio.
AVC.03.04	Distinguish between analog and digital audio formats.
AVC.03.05	Describe the difference in data signals and equipment for analog and digital technology.
AVC.03.06	Demonstrate how audio is synchronized with other audio or video.
AVC.03.07	Identify the key elements required in production scripts.
AVC.03.08	Explain how various styles of music can create a specific emotional impact.
AVC.03.09	Apply writing skills to the development of a production script.
AVC.03.10	Identify types and placement and use of lighting fixtures for various lighting effects.
AVC.03.11	Demonstrate lighting techniques used for remote and studio productions.
AVC.03.12	Demonstrate operation of communication technology equipment.
AVC.03.13	Demonstrate how to maintain equipment.
AVC.03.14	Describe how to frame and maintain composition.
AVC.03.15	Identify types of software used in the development of media (IE: video files. game design files. and animations).
AVC.03.16	Demonstrate how to use software for developing a message.

AVC.04	**Edit media productions to demonstrate basic skills in operating various elements in a production system.**
AVC.04.01	Define editing related to media productions.
AVC.04.02	Identify editing skills related to various delivery requirements, for various forms of distribution.
AVC.04.03	Describe the significance of digital technology production, and the required equipment related to editing.
AVC.04.04	Describe linear and nonlinear systems.
AVC.04.05	Demonstrate skills required for editing using these systems.
AVC.04.06	Edit programming utilizing various digital platforms.
AVC.05	**Analyze and apply laws affecting communication enterprises to maintain up-to-date compliance with key regulations influencing the industry.**
AVC.05.01	Analyze the copyright laws in relation to seeking formal permission to use materials.
AVC.05.02	Identify steps for securing permission to use copyrighted materials.
AVC.05.03	Exhibit how credit is given for use of copyrighted materials.
AVC.05.04	Define what original content is and when credit does not need to be given.
AVC.05.05	Identify the benefits and restrictions of copyright laws.
AVC.05.06	Identify consequences if formal permission is not secured.

GRAPHICS DESIGN TECHNOLOGY (GRADES 9-12)

GDT.01	**Discuss developments and individuals relating to the history of the graphics and design industry and explore emerging trends and technologies.**
GDT.01.01	Research technologies that advanced graphic design.
GDT.01.02	Describe past, present, and future styles in the graphic design field.
GDT.01.03	Identify art movements that impacted graphic design.
GDT.01.04	Describe the importance of graphic design's influence on society.
GDT.01.05	Identify persons with major contributions to the field of graphic design.
GDT.01.06	Identify and describe emerging trends and technologies.
GDT.02	**Communicate ideals using industry standard terminology .**
GDT.02.01	Formulate written and verbal communications using industry standard terms.
GDT.02.02	Prepare and deliver a visual presentation utilizing appropriate industry terminology.

STATE OF CONNECTICUT TECHNOLOGY EDUCATIONS STANDARDS

GDT.03	**Explore careers available in the field of graphic communications and the design industry.**
GDT.03.01	Identify the certificates, diplomas, and degrees available.
GDT.03.02	Compare and contrast careers in graphics and design, along with their education, training requirements, and salary ranges.
GDT.03.03	Identify the college majors that are found in the area of graphics design and communication.
GDT.03.04	List and describe professional organizations in the field of graphic design.
GDT.04	**Examine the professional and ethical issues involved in the graphic design industries.**
GDT.04.01	Identify basic copyright issues for graphic design industries to include understanding the use of Creative Commons copyright.
GDT.04.02	Explain the consequences of copyright infringement.
GDT.04.03	Explain ethics issues for the graphic design industries.
GDT.05	**Identify and apply the elements of design.**
GDT.05.01	Identify the applications of color, line, shape, texture, size, and value in samples of graphic work.
GDT.05.02	Analyze the use of color, line, shape, texture, size, and value in samples of graphic work.
GDT.05.03	Incorporate color, line, shape, texture, size, and value in student-generated graphic work.
GDT.05.04	Demonstrate the elements of design through manual sketching.
GDT.05.05	Demonstrate the elements of design through digital sketching.
GDT.06	**Identify and apply the principles of design.**
GDT.06.01	Analyze the principles of balance, contrast, alignment, rhythm, repetition, movement, harmony, emphasis, and unity in samples of graphic works.
GDT.06.02	Incorporate principles of balance, contrast, alignment, rhythm, repetition, movement, harmony, emphasis, and unity in student-generated graphic works.
GDT.06.03	Demonstrate the principles of design through various drawing techniques.
GDT.07	**Identify and apply the principles of typography.**
GDT.07.01	Identify the anatomical components and qualities of type (i.e., x-height, ascenders, descenders, counters, etc.)
GDT.07.02	Construct graphic works utilizing and manipulating type.
GDT.07.03	Apply and adjust formatting to type.
GDT.08	**Identify and apply the principles of design to layout.**
GDT.08.01	Apply effective use of negative space, composition, message structure, graphics, etc., to graphic works.
GDT.08.02	Create graphic works utilizing grids.
GDT.08.03	Create graphic works utilizing templates.

GDT.08.04	Demonstrate layout skills for print collaterals (i.e., business cards, newspapers, packaging, etc.)
GDT.08.05	Demonstrate layout skills for digital media.
GDT.08.06	Explain the importance of consistency of design.
GDT.08.07	Explain the importance of usability.
GDT.08.08	Explain the importance of core messaging.
GDT.08.09	Apply measurement tools and ratio analysis to image positioning in graphic works.
GDT.08.10	Solve aspect ratio proportion measurement in video and animation development.
GDT.09	**Demonstrate knowledge of concept development.**
GDT.09.01	Generate project ideas through the use of thumbnails, roughs, mock-ups, wireframes, etc.
GDT.09.02	Create a storyboard for a project
GDT.10	**Demonstrate knowledge of concept image creation and manipulation.**
GDT.10.01	Analyze differences and appropriate applications of vector-based and bitmap images.
GDT.10.02	Use a variety of input devices to import photos, images, and other content.
GDT.10.03	Incorporate the use of image manipulation and illustration software into final products.
GDT.10.04	Apply nondestructive image editing techniques such as layering and masking.
GDT.10.05	Practice using different selection tools and techniques to manipulate images.
GDT.10.06	Practice in-camera composition and cropping.
GDT.11	**Demonstrate application of media outputs.**
GDT.11.01	Use appropriate resolution, compression, and file formats for various media outputs including web, video, and print.
GDT.11.02	Incorporate appropriate color modes in graphic works including but not limited to RGB and CMYK.
GDT.12	**Demonstrate application of media outputs.**
GDT.12.01	Develop a workflow for a project.
GDT.12.02	Synthesize information collected from communications with various stakeholders.
GDT.12.03	Describe project management.
GDT.12.04	Create projects that define core message.
GDT.13	**Identify and apply the design process.**
GDT.13.01	Explain the design process.

GDT.13.02	Apply the design process to generate graphic works. Explain the design process. Apply the design process to generate graphic works.
GDT.14	**Demonstrate knowledge of branding and corporate identity.**
GDT.14.01	Analyze branding and corporate identity, its purpose and constituents.
GDT.14.02	Create a visual that contains all the richness of the brand.
GDT.15	**Identify and produce files utilizing different digital formats.**
GDT.15.01	Describe the strengths and weaknesses of TIFF, EPS, JPG, GIF, PDF, and PNG in a Postscript environment.
GDT.15.02	Create documents/images and demonstrate the ability to save as digital files.
GDT.15.03	Demonstrate how to place scanned graphics/photos into an existing page layout program.
GDT.15.04	Produce digital files using appropriate DPI and PPI resolution for media.

VIDEO PRODUCTION
GRADES 9-12

This semester course will introduce the student to the many aspects of video production. Students will learn basic skills such as storyboarding/pre-production, taping, and editing/post-production. Throughout, students will be exposed to proper technique not only in relation to videotaping, but also with regard to sound and lighting requirements. Students will be evaluated based upon sample videos relating to such themes as documentaries, advertisements, entertainment, and video journalism.

Credit: 0.5

VIDEO PRODUCTION
GRADES 9-12

UNIT 1: INTRODUCTION TO VIDEO PRODUCTION

Objectives

Students will understand video production as a communication tool and the equipment and skills required to properly communicate a message.
Students will safely utilize equipment and machinery used in the production of projects.
Students will explain career opportunities in the field of video production.
Students will explain the historical development of film, and then video.
Students will list the various applications of video production.
Students will define pre-production, production, and post-production.
Students will understand the TV studio set up and use as a production area.
Students will identify and use the proper terminology for the digital video area.

Essential Questions

How has video production affected our society in relation to entertainment, information, and our economy?
How much power, whether it is used to help or hurt an individual or group, does a video production wield, and why?
Why is "a picture worth a thousand words"?
What role does a newscast play as an information delivery system?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Video production is a field which offers diverse career choices for the individual, whether in front of the camera or behind the scenes.	In groups, students will analyze one modern example of a video production (documentary, advertisement, etc.). Based on past experiences, the students will analyze how that type of production has evolved, if in fact the production has served its purpose appropriate, and finally analyze the steps that may have gone into generating that production. Each group will present to the class.	Appropriate performance on student evaluation and/or classroom participation.
Video production is a rapidly changing technology; it has undergone a quick evolution.		
The video medium allows the creator to influence large populations of people in order to entertain, inform, or persuade.		
All video production can be divided into three realms: pre-production, production, and post-production.		
The TV studio allows information to be created ant transmitted to a mass audience.		

VIDEO PRODUCTION
GRADES 9-12

UNIT 2: CAST AND CREW

Objectives

Students will define the role of the following crew members: Producer, Director, Stage Manager, Camera Operator, Lighting Director, Audio Operator, Technical Director, Video Operator, Editor and On-Air Talent.

Students will explain why the choice of On-Air Talent may be different for various video applications such as newscasts, advertisements, documentaries, etc.

Students will explain why it is important to brief the cast and crew regarding the production plan, prior to production or an on air studio newscast.

Students will generate a basic production plan for a video, and explain its goals.

Essential Questions

Why is the producer so vital to the successful completion of the video project?

In what ways do the jobs of the producer, director, and stage manager differ? What ways do their roles overlap?

How important is input/feedback among the editor, director, and producer?

Which is the least important member of the crew? Which is the most important?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The majority of video production work is done by cast and crew members "behind the scenes."	The class will be divided into three groups, each with 4-5 members. Each group will be given the same task, to product a 5 minute informational video. It is each group's task to come up with a production plan, assigning jobs to the various members of their crew. While each person will perform more than one task, it is important for the group to divide the responsibilities clearly, effectively, and efficiently. Each group will present its ideas to the class.	Appropriate performance on student evaluation and/or classroom participation.
All cast and crew members are dependent upon one another to safely create a digital video project..		
On small video production endeavors with small crews, members may take over several responsibilities; while on large productions, specialists are hired for specific jobs.		
The duties and responsibilities of the production team will be explored for the use of the TV studio.		

VIDEO PRODUCTION
GRADES 9-12

UNIT 3: VIDEO EQUIPMENT

Objectives

Students will explain proper use and care of basic video equipment including cameras, tripods, editors, microphones, lights, Teleprompters, etc.
Students will appropriately set-up and break down equipment required for a video shoot.
Students will identify and apply the fundamental safety principles that relate to both field and studio production, including equipment setup, use and storage.
Students will safely set up and use ladders, electrical equipment, ladders and booms.
Students will perform basic camera shots and technique such as fade, focus, long shots, close-ups, stills, and moving camera.
Students will analyze and explain the different types of storage mediums.
Students will explain the difference between digital and analog video.
Students will describe the impact which appropriate lighting and audio tracks can have on the desired result and quality of the production.

Essential Questions

Why should everyone involved with a video production be aware of the capabilities of different video equipment?
Why should care be taken in the set-up, use, and break-down of video equipment in the field, as well as in the studio?
How can the manipulation of light and sound affect the overall purpose of the video?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Video equipment for ENG (Electronic News Gathering) and that for studio work can be varied as a result of their different requirements, and should be used appropriately to their intended purpose.	Working in groups, students will set up a shoot, tape a segment using basic video production equipment and appropriate technique, and then break down. Once the students have demonstrated this basic understanding of the techniques associated with gathering footage, the teacher will provide a basic editing demonstration by editing the segments into one clip. Groups should coordinate their segments with one another before shooting so that their footage will follow a general theme, common to a planned goal or objective.	Appropriate performance on student evaluation and/or classroom participation.
Video equipment is sensitive. Proper handling and use of it requires a high level of expertise.		
The application of specific video equipment techniques will enable the producer to convey a desired tone, appropriate to the video's purpose.		
Video is a dynamic field in which equipment, storage mediums, and technique changes constantly.		

VIDEO PRODUCTION
GRADES 9-12
UNIT 4: PRE-PRODUCTION

Objectives

Students will describe the process used for concept development and storyboarding as part of the pre-production process while focusing on the importance of communication, deadlines, and legal considerations.
Students will know that much time and effort must be invested in the concept and treatment development of a quality video production.
Students will identify script elements such as storyboarding, two column developments and the screenplay format used in pre-production.
Students will know a video production will not serve its intended purpose if its goals and objectives are not realized and clearly established in its pre-production.
Students will describe the rule of thirds, head room, lead room/talk space, establishing shot, extreme close up, close up, medium, medium wide, wide, extreme wide, and depth of field as it relates to camera composition/framing.
Students will define and describe the legal concerns of copyrights, ethics, releases, and royalties.
Students will identify budgeting issues, time constraints, and deadlines in meeting the requirements of a video project.
Students will evaluate shooting locations for lighting, sound, production equipment needs, and electrical essentials.
Students will develop a chronological plan, clearly stating what must be done, and by whom, is the foundation for a successful production.
Students will know the purpose of any video production should be based upon need, and will target the appropriate audience.

Essential Questions

Why do we spend as much time generating pre-production material, as we do on taping or editing? Explain using examples of the pre-production processes?
What effect could poor pre-production have on the final result of the production?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
As much time and effort must be invested in the planning stage of a quality video production, as is spent in the actual production and editing stages of it.	In groups, students will perform the pre-production work for a 30 second commercial for a product of their choice. The team must clearly define the need and purpose for the production. Objectives must then be generated and an outline based upon them must be constructed. Next, a visual storyboard including scene, sketch, and narration must be created. Finally, a script must be drafted in a two column format (Left column for description of visual (video) material, and a Right column for audio). The plan will be presented to the class for evaluation.	Appropriate performance on student evaluation and/or classroom participation.
A video production will not serve its intended purpose if its goals and objectives are not realized and clearly established in its pre-production.		
A chronological plan, clearly stating what must be done, and by whom, is the foundation for a successful production.		
The purpose of any video production should be based upon need, and not desire.		

The purpose of a studio newscast is to inform the audience in a non-biased way.	Student groups will plan a newscast. The newscast will incorporate studio and control room equipment and personnel.	Appropriate performance on student evaluation and/or classroom participation

VIDEO PRODUCTION
GRADES 9-12

UNIT 5: PRODUCTION

Objectives

Students will identify and describe the elements of digital media production to effectively deliver a message.
Students will demonstrate proper use and care of basic video equipment and personnel necessary for producing a field production.
Students will appropriately set-up and break down equipment required for a video shoot; this includes cameras, tripods, lighting and sound equipment.
Students will perform basic camera shots and techniques such as fade, focus, long shots, medium shots, close-ups, stills, and moving camera.
Students will analyze and utilize the different types of storage mediums.
Students will describe the impact which appropriate lighting and audio tracks can have on the desired result and quality of the production.
Students will describe dolly, truck, pan, and tilt as it relates to camera movements.
Students will read, analyze, and follow a storyboard and/or a script while composing and taping shots.

Essential Questions

What conditions must be considered before videotaping on any shoot?
Why should checklists, whether mental or physical, be used while preparing to shoot, or while shooting?
Why should checklist, be used while preparing to shoot, or while shooting in a TV studio?
Why should the camera operator follow shot composition, camera movements, etc., which were developed and placed on the storyboard / script?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The operator must be totally familiar with the use and care of his/her equipment before heading into the field to secure footage.	In groups, the students will tape the video footage necessary to the production planned out in the previous unit. Students must demonstrate proper set-up, use of, and take-down of the video equipment. They must also possess enough quality footage to produce their video. Student groups will shoot a newscast. The newscast will incorporate live shots and b-roll footage used by studio and control room equipment and personnel.	Appropriate performance on student evaluation and/or classroom participation.
The two most important considerations when taping are light and movement.		
Securing video footage must be done carefully and responsibly because some shots, whether in the field or the studio, may never be able to be replicated.		
Taping techniques may differ when shooting in the field, or a studio.		

VIDEO PRODUCTION
GRADES 9-12

UNIT 6: POST-PRODUCTION

Objectives

Students will identify and describe the elements of post-production to effectively deliver a digital video message.
Students will generate and implement titles into the video production.
Students will perform basic editing to finalize images and video for rough cut, transitions, color correction, keying, and pacing with nonlinear software.
Students will explain play head, timeline, bin, multiple tracks, trimming, and edit points within nonlinear video editing.
Students will list the advantages and disadvantages of both Linear and nonlinear editing.
Students will create graphics and titles appropriate to the project.
Students will describe and apply import, file, and asset management.
Students will edit audio for voice over, audio levels, music, and sound effects with application software.
Students will identify and use the digital literacy terminology: aspect ratios, screen resolution, frame rate, file formats, codec, compression, bit rate, and display properties
Students will produce a clean, edited, final copy of a video based on its original goals and objectives.

Essential Questions

Why is so much time spent on the editing/post-production phase of the video production?
What impact has digital technology had on post-production?
In what ways can the quality of editing affect the quality and/or the overall tone of the production?
Why is it important to edit with a partner?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
It is extremely important to create a video log and make decisions about editing before entering the editing suite.	In groups, the students will edit their footage captured in the last unit, into a quality video production based on the original goals and objectives drafted during Pre-Production. The videos will be presented to the class, and then analyzed for both technical and artistic quality. Students will edit b-roll stories that can be used in a TV studio newscast.	Appropriate performance on student evaluation and/or classroom participation.
It is impossible to edit footage into a quality finished product if the field or studio shots were performed incorrectly, or if the wrong shots were taped.		
Digital, nonlinear editing provides many advantages over linear editing.		
Editing is the area of video production which requires the largest investment of time for the amount of finished product.		

VIDEO PRODUCTION
GRADES 9-12
STUDENT PROJECT EVALUATION RUBRIC

Video Project: _____ Student: _____

	0-5	6-10	11-15	16-20	Total
Story	Student did not complete story. Story not descriptive or containing 3 paragraphs	Story is poorly prepared, not very descriptive. There are not 3 paragraphs that represent the beginning, middle and end.	Story is complete is fairly descriptive, describing behavior, facial expressions, action and dialog. Has 3 paragraphs that represent the beginning, middle and end.	Story is well-prepared, is very descriptive, describing behavior, facial expressions, action and dialog. Contains 3 paragraphs that represent the beginning, middle and end.	
Storyboard	Cannot understand Storyboard presentation because there is no sequence of information. Cannot be used as a guide and reflects very little or no planning at all.	Difficulty following storyboard presentation, not much attention to details. Glaring omissions to visual planning.	Student storyboard information in logical sequence which audience can follow. Presentation is relatively complete.	Student storyboard presents information in logical, interesting sequence which audience can follow and understand easily. Reflects outstanding planning and organization.	
Editing	No editing or edited with very poor shots, no angles.	Little evidence of correct editing technique. Jumps from shot to shot, scenes do not flow smoothly.	Edited with good shots. Video moves well and communicates the main idea.	Excellent evidence of correct editing technique. Video moves smoothly from shot to shot. A variety of angles are used to communicate he main idea.	
Video	The video does not follow the story and does not convey the prompt.	The video barely follows the story and hardly conveys the prompt.	The video follows the story and storyboard very well and generally conveys the prompt	The video follows the story and storyboard exactly and conveys the prompt completely.	
Use of Time/ Group Work	Very poor time on task. Cannot share in decisions and responsibilities	Difficulty staying on task for more than 50% of the period. Difficulty sharing in decisions and responsibilities	Worked most of the period, about 75%. Works well with others, does fair share of work on prompt.	Worked all period. Works well with others. Assumes a clear role and is motivated to contribute to the prompt.	
				Total Points/Grade	

VIDEO PRODUCTION
GRADES 9-12

RESOURCES

Video Communication and Production, Stinson, J. 2002, Tinley Park: Goodheart-Wilcox.

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: Introduction to Video Production	X	
Unit 2: Cast and Crew	X	
Unit 3: Video Equipment	X	
Unit 4: Pre-Production	X	>
Unit 5: Production		X
Unit 6: Post-Production		X

ADVANCED VIDEO PRODUCTION
GRADES 10-12

The Advanced Video Production course will continue with the concepts that were learned and developed in the Video Production course. The course takes an advanced look into television studio, broadcast news and field productions. The course teaches advanced technical and aesthetic concepts involved in successful studio, broadcast news and field production. Students will continue to develop their skills through a series of class exercises, studio broadcasts and field exercises and critical evaluations of past and present production styles. Students may be instructed to apply their video production skills toward two required "school and/or community-centered" assignments per semester as part of the course requirements.

Prerequisite: Video Production

Credit: 1.0

ADVANCED VIDEO PRODUCTION
GRADES 10-12

UNIT 1: HISTORY OF DIGITAL MEDIA PRODUCTIONS

Objectives

Students will describe digital media as a communication tool and the equipment and skills required to properly communicate a message.
Students will explain the role of the networks, cable television, market share and ratings.
Students will identify the differences between a studio production and a field production.
Students will list ways that television influences the viewing masses.
Students will list ways that television newscast influences the viewing masses.
Students will explain the impact that television technology and other new developments have on society.
Students will define and describe the legal concerns of copyrights, ethics, releases, and royalties.

Essential Questions

What method of communication was used in different historical periods and civilizations?
How has television, mass media and news coverage affected our society in relation to news, entertainment, information, and our economy?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Within the communication field, video production is a relatively new technology; it constantly changes with the advent of new technologies.	In groups, students will analyze one major news story. The news story will be analyzed to see the similarities and differences of how it was reported by at least three news-reporting agencies. (Newspaper, magazine, radio, television, etc.) Based on past experiences, the students will analyze how each type of news-reporting presents the story. They will determine if each news-reporting agency has served its purpose appropriately, and finally analyze the steps that may have gone into generating that production. Each group will present to the class.	Appropriate performance on student evaluation and/or classroom participation.
Video communication allows the broadcast networks to impact large populations of people in order to entertain, inform, or persuade.		
Video and television news broadcasts can impact the political and social climate for its viewers.		
Future technological developments in the mass communication field will lead to greater consumer use of technology.		

ADVANCED VIDEO PRODUCTION
GRADES 10-12

UNIT 2: DIGITAL MEDIA PRODUCTION

Objectives

Students will outline the job description for each crew member of a production team: Producer, Director, etc.
Students will explain why the choice of On-Air Talent may be different for various video applications such as advertisement, documentary, etc.
Students will explain why it is important that all member of the production team understand the production plan, prior to production.
Students will generate a pre-production and production plan for a video, and explain its expected goals.
Students will generate a pre-production and production plan for a TV news broadcast, and explain its expected goals.
Students will describe and apply fundamental camera operations, movement, and composition.
Students will describe white balance, iris, aperture, auto and manual focus, audio settings, and levels in camera operations.

Essential Questions

Why does the producer get the most credit or criticism upon the completion of the video project?
In what ways are the behind the scenes role of the producer, director, and stage manager similar and different?
In what does a newscast differ that television program in use of the production team members?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The television production team members do the "what" and "when" for the majority of video production work.	The class will be divided into groups; this will constitute a production team. Each group will be given the task, to produce a 5-minute newscast video. The style will be of the ENG (electronic news gathering) variety. The topic will be school or community related. It is each group's task to come up with a pre-production and production plan, assigning jobs to the various members of their crew e.g. on air talent, reports, studio crew. While each person may perform more than one task, it is important for the group to divide the responsibilities clearly, effectively, and efficiently. Each group will present its ideas to the class prior to an on air news broadcast.	Appropriate performance on student evaluation and/or classroom participation.
All television production team members are dependent upon one another to complete a video production project or program.		
On video production projects with small crews, members may take over several of the production team responsibilities, while on large productions; production team specialists are hired for specific jobs.		

ADVANCED VIDEO PRODUCTION
GRADES 10-12

UNIT 3: VIDEO CAMERA OPERATIONS AND FUNCTION

Objectives

Students will set up, use and care for of video equipment including cameras, tripods, microphones, lights, etc., in the field and the studio.
Students will describe and apply the fundamental principles safely that relate to both field and studio production.
Students will demonstrate safe set-up and break down equipment required for a video shoot.
Students will demonstrate appropriate framing of shots, including correct headroom, extreme close ups, close ups, medium shot, long shot, and group shots.
Students will identify RCA, BNC, RF, SVHS connectors, adaptors and cables.
Students will explain the difference between digital and analog video.
Students will recognize various production situations and be able to demonstrate appropriate camera blocking for each situation.
Students will identify and use white balance, iris, aperture, auto and manual focus, audio settings, and levels in camera operations.)
Students will identify and use dolly, truck, pan, and tilt as it relates to camera movements.
Students will identify and use the following methods of stabilization: tripod, monopod, slider, steady cam, fluid head, friction head, and dolly.
Students will identify and use the rule of thirds, head room, lead room/talk space, establishing shot, extreme close up, close up, medium, medium wide, wide, extreme wide, and depth of field as it relates to camera composition/framing.

Essential Questions

Why should everyone involved with a video production be able to use field and studio cameras?
What steps should be taken in the set-up, use, and break down of video production equipment? Is there a difference for on location and studio equipment?
How does the use of movement (tilt, zoom, and pan) influence the shot?
When setting up a shoot why is it necessary take direction and to understand appropriate framing of shots?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Video equipment used in a television studio is much more elaborate and expensive than that used in the field. Video equipment for ENG (Electronic News Gathering) should be used appropriately for their intended purpose. Video equipment needs to be properly handled and the use of it requires a high level of care and expertise. The application of various video and camera	1.) Working in groups, students will set up an on location shoot and tape a news segment using basic video production equipment. Groups should coordinate their segments with one another before filming so that their footage will follow the pre-production goal or objective. They will apply appropriate camera technique, and then break down the camera and equipment when the shoot is complete. After the students have demonstrated an understanding of the techniques associated with gathering footage, they will do basic editing techniques,	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED VIDEO PRODUCTION
GRADES 10-12

Knowledge and Skills	Instructional Strategies	Evidence of Learning
techniques will allow the producer to convey a desired tone, appropriate to the video's purpose. The equipment used in the video production field changes constantly with advancements in technology.	by editing the filmed segments into one clip. 2.) Working in groups, students will set up a studio shoot and tape a news segment using basic video studio production equipment.	

ADVANCED VIDEO PRODUCTION
GRADES 10-12

UNIT 4: AUDIO, SOUND AND LIGHTING CONTROL

Objectives

Students will describe the impact that appropriate lighting and audio tracks can have on the desired result and quality of the production.
Students will demonstrate the setup of lighting and audio equipment for use in the field and tv studio.
Students will use the audio mixing board and demonstrate audio mixing techniques.
Students will demonstrate appropriate microphone choice and placement for various field and tv studio situations.
Students will understand the concept of basic three-point lighting.

Essential Questions

Why should everyone on a video shoot understand how different types of microphones operate to pick up sound?
How does the use of proper lighting techniques affect the quality of a video production shoot?
The use of lighting effects and audio effects can change the mood or perception of a video shoot. How? Why?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Lighting used in a video production project can affect and change the perception of the desired outcome.	Working in groups, students will set up, film and record an interview to be used as a b-roll in a newscast. The use of lighting will be used during the filming of the interview. Once the interview is filmed the students will demonstrate their understanding of audio editing by adding voice over, sound effects and background music. Once final editing is complete the final interview will be presented as a b-roll segment for a newscast.	Appropriate performance on student evaluation and/or classroom participation.
Sound and audio equipment is used to enhance many video production projects.		
Proper set up and use of lighting and sound equipment is essential for a quality video production or newscast project.		
Audio mixing techniques are used in the editing studio to add sound effects and/or background music to enhance the video recording or establish mood.		

ADVANCED VIDEO PRODUCTION
GRADES 10-12

UNIT 5: SCRIPTWRITING AND PRE-PRODUCTION

Objectives

Students will identify storyboard, documentary, news and screenplay scripts.
Students will describe the process used for concept development and storyboarding as part of the pre-production process while focusing on the importance of communication, deadlines, and legal considerations.
Students will identify a target audience and design an appropriate message for the target audience.
Students will explain the impact which pre-production work can have on the quality of the video production.
Students will create a broadcast script following the outline set forth in a pre-production plan.
Students will list the outcomes of quality pre-production work.
Students will define and describe the legal concerns of copyrights, ethics, releases, and royalties.
Students will explain the importance of budgets, scheduling, and deadlines in meeting the requirements of a project.
Students will evaluate a shooting location in terms of lighting, sound, production equipment needs, and electrical essentials.
Students will demonstrate the use of storyboard types as they relate to a script.

Essential Questions

Why do we spend as much time generating scripts and storyboards in the pre-production phase of the video process?
What effect could poor scriptwriting and storyboard development during the pre-production phase have on the final result of the production?
Why do the goals and objectives of a video production project need to be clearly stared and understood by all production team members?
During pre-production who has the ultimate responsibility to communicate the goals and objectives of the video production process?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
All video production projects use a three-part process; Pre-production, Production, and Post-production. Each part of the production process is important for the overall success of the video project.	In groups, students will perform the pre-production work including a storyboard and script for news broadcast style program. The news broadcast will part of a series of broadcasts that will educate your fellow students on the customs of different cultures in our school. The goal of the production must be clearly stated, the objective of the project need to be evident within the script and storyboard. A visual storyboard including scene, sketch, and narration must be created. A script must be drafted to accompany the storyboard. The plan will be presented for evaluation.	Appropriate performance on student evaluation and/or classroom participation.
During the pre-production phase of video production the project goals are clearly established and the intent and purpose of the production project are clearly stated.		
The script, storyboard and pre-production shot lists lay the groundwork for the entire cast and crew used in any video production or newscast project.		

ADVANCED VIDEO PRODUCTION
GRADES 10-12

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The skills needed to write scripts and layout storyboards may not be technical but must clearly relate the project ideas to the entire production team.		

ADVANCED VIDEO PRODUCTION
GRADES 10-12

UNIT 6: TELEVISION AND STUDIO BROADCASTING

Objectives

Students will identify and describe the elements of news broadcasting to effectively deliver a message.
Students will demonstrate proper use and care of video equipment.
Students will demonstrate proper use and care of studio equipment.
Students will set-up and break down cameras, lights, tripods, etc. required for a video shoot or newscast.
Students will describe, plan the use of, and apply 3-point lighting, source light, white balance, scrims, and reflectors using the appropriate techniques.
Students will describe the various types of sound equipment and techniques used with handheld, lavaliere, shot gun, condenser, omni and directional methods.
Students will set-up and break down audio mixer, video board, teleprompter, etc. required for a video shoot or newscast.
Students will follow the shot list set up in pre-production.
Students will function as a member of a broadcast team.
Students will make sure there is adequate lighting and audio for a video shoot.

Essential Questions

What on site preparation is needed to do a video shoot outside the studio?
What studio preparations are needed before film can be shot?
What studio preparations are needed before a newscast can be shot?
Why is an equipment and site checklist important for a successful video or news shoot?
Why is it important for the cameraman to fully understand the storyboard and script that were developed in pre-production?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The onsite filming of a video production project requires that all members of the newscast team understand the goals and objective of the shoot. During any video shoot the technical personnel are required to understand the proper use and care of the studio and production equipment. Important consideration is given to set lighting and audio transmission during a news broadcast shoot. Video footage needs to be cataloged and saved, so that all filmed footage can be reviewed, for use	1.) In groups, the students will tape the video footage necessary to the production planned out in an approved topic that has gone through the pre-production planning phase. Students must demonstrate proper set-up, use of, and takedown of the video, audio and lighting equipment. They must shoot enough quality footage to produce their planned video. 2.) In groups, the students will tape a newscast using all the necessary production planning on an approved topic that has gone through the pre-production planning phase. Students must demonstrate proper set-up, use	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED VIDEO PRODUCTION
GRADES 10-12

Knowledge and Skills	Instructional Strategies	Evidence of Learning
in the post-production phase of newscast productions.	of, and takedown of the video, audio and lighting of studio equipment.	
Film shot in the studio has different technical requirements than those shot in the field.		
The studio filming of a newscast project requires that all members of the production team understand the goals and objective of the shoot.		

ADVANCED VIDEO PRODUCTION
GRADES 10-12

UNIT 7: EDITING PRINCIPLES IN POST-PRODUCTION

Objectives

Students will Identify and describe the elements of post-production to effectively deliver a message.
Students will apply import, file, and asset management in non-linear formats.
Students will demonstrate appropriate editing and finalization of images and video for rough cut, transitions, color correction, keying, and pacing with nonlinear software.
Students will describe and apply import, file, and asset management in the post production process.
Students will edit and finalize images and video for rough cut, transitions, color correction, keying, and pacing with nonlinear software.
Students will identify play head, timeline, bin, multiple tracks, trimming, and edit points within nonlinear video editing.
Students will select appropriate titles, transitions and credits for the end product.
Students will demonstrate appropriate use of sound levels, music and sound effects, with various application software.
Students will understand and calculate time as it relates to editing.
Students will operate editing software and equipment, switcher, audio mixer in both linear and nonlinear editing.

Essential Questions

The editing/post-production phase of the video production tends to take the most time. Why do you think that is?
The editing phase of newscast varies with the type of news article being presented. What are the types of news articles used in a newscast?
Why should editors explore all aspects of the editing software and editing features?
How does the editing affect the overall quality of the video production project?
When editing a project why is it important for the editor to fully understand the entire production process?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
It is extremely important to create a video production plan and make editing choices prior to beginning the editing phase. The quality of the filmed raw footage has a direct effect on the quality of the finished edited product. Editing done in a studio using digital equipment has advantages over film edited using linear editing equipment. Editing of video footage requires a substantial time investment to obtain the desired outcome of a quality-finished product.	1.) In groups, the students will edit their footage captured in previous units. They will digitally edit their footage based on the original goals and objectives drafted during Pre-Production. The outcome should be a quality video production project. The videos will be presented to the class, and then analyzed for both technical and artistic quality. 2.) In groups students will edit the articles created for a newscast. They will follow the news timelines set in preproduction. The videos will be presented for use in a newscast.	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED VIDEO PRODUCTION
GRADES 10-12
UNIT 8: DIGITAL MEDIA CAREERS

Objectives

Students will identify various career paths in digital media production.
Students will list skills, attitudes, abilities and training required for jobs in the video production industry.
Students will describe employment opportunities in the video production or news broadcasting industry.
Students will conduct a job search using newspapers, trade magazines and the internet.
Students will complete an employment application form correctly.
Students will demonstrate competency in job interview techniques.
Students will identify acceptable work habits.

Essential Questions

What type of careers can be found other than on screen talent, in the video production field?
What types of personal skills are needed to work in the video production and news broadcasting field?
Name various technical skills that would be beneficial for a person looking for a career in video production?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Video production is a field that offers diverse career choices for the individual, whether in front of the camera or behind the scenes.	Each student will prepare an employment inventory of skills needed in the video production field. They will use this inventory while preparing an in depth analysis of a career that can be found in the video production field. The analysis will include: job description, schooling or training, cost of schooling or training, where to school or train, job outlook, related field or careers, projected salary, work environment, related information or useful web sites. An interview with someone working in the field will be included. Each student will present to the class.	Appropriate performance on student evaluation and/or classroom participation.
Various career opportunities in video production and news broadcasting can be found in our local area.		
For advancement in the video production field workers need to be aware of the entire production process.		
Students will be able to match their employability skills with those needed in the video production field.		

ADVANCED VIDEO PRODUCTION
GRADES 10-12
STUDENT PROJECT EVALUATION RUBRIC

Video Project: _____ Student: _____

	0-10	11-20	21-30	31-40	Totals
Storyboarding	Cannot understand Storyboard presentation because there is not enough information; contains major mistakes or omissions.	Difficulty following storyboard presentation, not much attention to details, with noticeable mistakes or omissions.	Student storyboard information in logical sequence that can be followed; with only minor mistakes or omissions.	Student storyboard presents information in logical, interesting sequence which audience can follow and understand easily.	
	0-6	**7-13**	**14-22**	**23-30**	**Totals**
Filming	Group did not complete filming. No attention given to script content, filming shots and camera angles.	Filming is poorly prepared and executed. Little attention given to script content, filming shots and camera angles.	Filming is complete with only a few mistakes. Attention given to script content, filming shots and camera angles.	Filming is well-prepared, easy to follow and presented professionally. Extra attention given to script content, filming shots and camera angles.	
	0-6	**7-13**	**14-22**	**23-30**	**Totals**
Editing	Group did not complete editing of raw footage. Missing opening, edited tape or credits.	Group only completed editing of one or two film requirements. (opening, edited tape or credits).	Group completed editing as assigned with few mistakes.	Group completed editing as assigned with minor or no mistakes. Attention given to film requirements.	
				Total Points:	

ADVANCED VIDEO PRODUCTION
GRADES 10-12

RESOURCES

Video Communication and Production, Stinson, J. 2002, Tinley Park: Goodheart-Wilcox.
Video Production: Disciplines and Techniques, Burrows, T.D., Gross, L.S., Foust, J.C. and Wood, D.N. Eighth Edition.
www.cybercollege.com

PACING GUIDE

Unit	Semester 1	Semester 2
Unit 1: History of Digital Media Productions	X	
Unit 2: Digital Media Productions	X	
Unit 3: Video Camera Operations and Functions	X	
Unit 4: Audio, Sound and Lighting Control	X	
Unit 5: Scriptwriting and Pre-Production	X	
Unit 6: Television and Studio Broadcasting		X
Unit 7: Editing Principles in Post-Production		X
Unit 8: Digital Media Careers		X

STATE OF CONNECTICUT TECHNOLOGY EDUCATION STANDARDS

DIGITAL VIDEO PRODUCTION (GRADES 9-12)

DVP.01	**Video Production Skills: Understand video production as a communication tool and the equipment and skills required to properly communicate a message.**
DVP.01.01	Describe the various video production processes, when integrated together to create a successful message.*(A1)
DVP.01.02	Describe the differences between a studio production and a field production.*(A2)
DVP.01.03	Identify various career paths in digital/video production.*(A3)
DVP.02	**Safety: Describe and apply the fundamental principles that relate to both field and studio production.**
DVP.02.01	Demonstrate fire safety prevention and extinction, and trip hazards as it relates to lighting and electrical equipment.*(B4)
DVP.02.02	Describe the fundamentals of step ladder safety.*(B5)
DVP.02.03	Identify proper methods of transport and storage for appropriate production and personal equipment.*(B6)
DVP.02.04	Describe and apply fundamentals of cable safety.*(B7)
DVP.03	**Pre-Production: Describe the process used for concept development and storyboarding as part of the pre-production process while focusing on the importance of communication, deadlines, and legal considerations.**
DVP.03.01	Identify a target audience and design an appropriate message for the target market.*(C8)
DVP.03.02	Describe the process used for concept development/treatment.*(C9)
DVP.03.03	Identify and describe the script elements of storyboarding, two column, and screenplay format.*(C10)
DVP.03.04	Define and describe the legal concerns of copyrights, ethics, releases, and royalties.*(C11)
DVP.03.05	Explain the importance of budgets, scheduling, and deadlines in meeting the requirements of a project.*(C12)
DVP.03.06	Evaluate a shooting location in terms of lighting, sound, production equipment needs, and electrical essentials.*(C13)
DVP.04	**Production: Identify and describe the elements of production to effectively deliver a message.**
DVP.04.01	Describe, plan the use of, and apply 3-point lighting, source light, white balance, scrims, and reflectors using the appropriate techniques.*(D14)
DVP.04.02	Describe the various types of sound equipment and techniques used with handheld, lavaliere, shot gun, condenser, omni and directional methods.*(D15)
DVP.04.03	Describe the equipment and personnel necessary for producing a studio production.*(D16)
DVP.04.04	Describe the equipment and personnel necessary for producing a field production.*(D17)
DVP.05	**Cinematic Principles: Describe and apply fundamental camera operations, movement, and composition.**
DVP.05.01	Describe white balance, iris, aperture, auto and manual focus, audio settings, and levels in camera operations.*(E18)
DVP.05.02	Describe dolly, truck, pan, and tilt as it relates to camera movements.*(E19)

DVP.05.03	Describe the following methods of stabilization: tripod, monopod, slider, steady cam, fluid head, friction head, and dolly.*(E20)
DVP.05.04	Describe the rule of thirds, head room, lead room/talk space, establishing shot, extreme close up, close up, medium, medium wide, wide, extreme wide, and depth of field as it relates to camera composition/framing.*(E21)
DVP.06	**Post-Production: Identify and describe the elements of post-production to effectively deliver a message.**
DVP.06.01	Create graphics and titles appropriate to the project.*(F22)
DVP.06.02	Describe play head, timeline, bin, multiple tracks, trimming, and edit points within nonlinear video editing.*(F23)
DVP.06.03	Describe and apply import, file, and asset management.*(F24)
DVP.06.04	Edit and finalize images and video for rough cut, transitions, color correction, keying, and pacing with nonlinear software.*(F25)
DVP.06.05	Edit audio for voice over, sound levels, music, and sound effects with application software.*F26)
DVP.07	**Media Components and Concepts: Identify and understand the technological literacy of video production.**
DVP.07.01	Describe the following digital literacy terminology: aspect ratios, screen resolution, frame rate, file formats, codec, compression, bit rate, and display properties.*(G27)

TRANSPORTATION / ROBOTICS
GRADES 9-12

This course is designed for the student who wants to explore robotics and the four realms of transportation; Terrestrial, Marine, Air, and Space. Students will learn transportation concepts through class work and hands-on activities. Projects may include a working robot, air powered model car, boat hull, submarine, electric motor, and rockets. This class will be taught from a hands-on, problem solving approach.

Credit: 0.5

TRANSPORTATION / ROBOTICS
GRADES 9-12

UNIT 1: INTRODUCTION

Objectives

Students will explain and define the three areas of transportation: Terrestrial, Marine, and Aerospace.
Students will discuss the evolution of each area of transportation.
Students will discuss the importance of each area, and their influence of each on society, the economy, and national security.
Students will explore each area and discuss ways to improve or make changes that would benefit society and the environment.
Students will forecast trends in transportation technologies and project their potential impacts.
Students will evaluate transportation technologies based on their positive outcomes.
Students will discuss the application of various power technologies within the realm of transportation technology.
Students will discuss career opportunities in, as well as the impact of government regulation on the areas of transportation.

Essential Questions

What would be examples of future trends in transportation?
Why is the environment an area of focus?
What process must be followed to make changes in transportation?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Transportation is an important technology that influences our lives on a daily basis.	In addition to tests and quizzes, each student will create ten transportation career portfolios.	Appropriate performance on student evaluation and/or classroom participation
Technological changes in transportation will provide diverse career opportunities which will require intense and on-going education.		

TRANSPORTATION / ROBOTICS
GRADES 9-12

UNIT 2: SAFETY

Objectives
Students will define some of the safety concerns in a transportation lab.
Students will discuss personal responsibility for individual and group safety.
Students will indicate the locations of emergency stop buttons, exits, exit routes, eyewash station, first aid kit, and firefighting equipment.

Essential Questions
What are the dangers in performing construction activities in the shop?
How can these dangers be reduced or eliminated?
Upon which trade or job position does responsibility lie for the safe performance, completion or quality of a given operation?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Safety is a personal and a group responsibility. Fabrication is an occupation whose many dangers can be minimized with forethought and an appropriate attitude.	Practice emergency drills for fire and injury. Students will pass a prescribed safety instruction unit before using the lab, tools, or equipment. Instructor monitors continuously, and students practice mutual feedback for compliance with safety procedures.	Appropriate performance on student evaluation and/or classroom participation. Use of the Tech. Ed. Department PLC safety unit to prepare and monitor student safety preparation and practices.

TRANSPORTATION / ROBOTICS
GRADES 9-12

UNIT 3: LAND TRANSPORTATION

Objectives

Students will explain and define the two main categories of land transportation.
Students will define the roles of the six technologies in land transportation technology.
Students will discuss the importance of land transportation within our society.
Students will create and evaluate a fixed route method to transport people and goods across the United States.
Students will create and evaluate a random route to transport people and goods across the United States.
Students will explore the problem of determining payload and distance requirements for a specific vehicle.

Essential Questions

What role has the interstate highway system, railway system, and pipeline played in the evolution of land transportation?
What role does society play in the evolution of land transportation?
Do technological transportation advancements always improve our society?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Land transportation is a major industry that moves people goods and products in all countries of the world.	Students will build and test a land transportation such as passenger car or delivery vehicle that will travel a set distance in the least amount of time. This will incorporate aerodynamics and reduced friction between moving parts. Research project: Given a geographical location, determine the most effective method to transport people, goods, and products.	Appropriate performance on student evaluation and/or classroom participation.
All modes of transportation have certain types of technology which are specific to them.		
A relation exists between propulsion, suspension, guidance, control, support, and structure systems in any vehicle.		

TRANSPORTATION / ROBOTICS
GRADES 9-12

UNIT 4: MARINE TRANSPORTATION

Objectives

Students will explain and identify the cost and need for marine transportation.
Students will identify the important waterways used for marine transportation in the United States.
Students will compare several types of vessels, crafts, and boats used for marine transportation.
Students will discuss the various type of boats and crafts used in the recreational area of the marine transportation industry.
Students will explain the different propulsion systems used in marine applications.
Students will explain the different drive systems used in marine applications.
Students will explain and identify how materials can be shaped to produce buoyancy.
Students will define the two classifications of hull design.

Essential Questions

What type of hull would transport liquid cargo over vast bodies of water?
What type of vessel would transport cargo over the inland waterways of this country?
Does the density of fuel and salt water effect the movement of a vessel?
How do hull designs impact on energy conservation?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Marine transportation is a cost-effective means of moving large cargo over long distances due to its high ton-per-mile ratio.	Students research the densities of fresh and salt water and how they affect movement of a vessel. Given a predetermined material constraint, construct a boat hull that will float and carry a cargo. Test and data report required.	Appropriate performance on student evaluation and/or classroom participation.
The recreational side of the marine industry plays a major role in our society.		
The efficiency of marine transportation depends on hull functions.		

TRANSPORTATION / ROBOTICS
GRADES 9-12
UNIT 5: AIR TRANSPORTATION

Objectives

Students will define facets aviation industry, including the agencies and companies involved.
Students will identify the important parts of an aircraft.
Students will design and construct a model glider.
Students will test a glider and record flight data.
Students will redesign the glider based on the flight data.
Students will explain the need for airfoils, stabilizers, and propulsion systems in an aircraft.
Students will explain prop pitch as it relates to speed and efficiency.
Students will explain the impact of Bernoulli's principle on flight.

Essential Questions

What is the best shape of a lighter than air vehicle?
Why is a lighter than air vehicle not used commercially?
What gases are used for lighter than air vehicles?
Explain the mechanics of lift as it relates to airfoil design.
What causes oxygen to decrease as altitude increases?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Large volumes of lighter than air gasses can lift heavy loads.	Students will build a lighter-than-air vehicle to be able to lift its own weight and a pre-determined cargo. Students will build a glider and test the airfoil principle of lift. Students will design an air balloon out of tissue paper, calculate volume of heated air to lift a specific amount of weight.	Appropriate performance on student evaluation and/or classroom participation.
As speed increases the pressure on the smaller area is greater than the pressure on the larger area of an airfoil, giving it lift, Bernoulli's principal.		
The oxygen level decreases as altitude increases.		

TRANSPORTATION / ROBOTICS
GRADES 9-12

UNIT 6: SPACE TRANSPORTATION

Objectives

Students will identify the need for space transportation and exploration.
Students will describe the past and present programs of space exploration.
Students will describe the characteristics of the space environment, including the atmosphere, and weightlessness.
Students will design and construct a model rocket to use a combination of liquid and air for propulsion.
Students will test the rocket performance.
Students will redesign and retest the rocket to improve performance.
Students will build and test a rocket with a cargo load.
Students will describe both past and present space programs.
Students will describe and explain the importance of spin-off technologies which evolved from the space program.

Essential Questions

Is it possible for humans to form colonies in space?
What will a future space transport vehicle look like?
Should space exploration be regulated?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Space transportation will have significant importance in the future.	Satellite orbiting investigation. Presentation, posters, and debates are strategies for this topic.	Appropriate performance on student evaluation and/or classroom participation.
To exist on zero gravity, much technology will be needed.	Air filled balloon inside helium filled balloon to test anti-gravity forces to simulate decreasing gravitational pull. Design and construct 4 model rockets to use a combination of liquid and air for propulsion.	

TRANSPORTATION / ROBOTICS
GRADES 9-12

TRANSPORTATION CLASS RUBRIC

	4 Exceptional	3 Proficient	2 Minimal	1 inadequate	Score
Communicate in Standard English	Student demonstrates high skill in following direction, providing verbal discourse, and writing lab reports.	Student demonstrates average skills in following direction, providing verbal discourse, and/or writing lab reports.	Student demonstrates little skill in following direction, providing verbal discourse, and/or writing lab reports.	Little attempt at communication was evident, and/or lab report was not completed.	
Read and understand a variety of materials	Always reads a variety of materials for a complete understanding of the task at hand.	Reads a variety of materials related to the task at hand.	Most of the time, material is read for the task at hand.	Seldom reads any material for the task at hand.	
Apply mathematical principles to solve and justify problems	Student demonstrates high skill in problem comprehension, problem application, and accurate evaluation of the problem.	Student demonstrates average skills in problem comprehension, problem application, and/or accurate evaluation of the problem.	Student demonstrates little skill in problem comprehension, problem application, and/or accurate evaluation of the problem.	Little attempt at a mathematical solution to problem is attempted or comprehended.	
Evaluate information to interpret events and make informed responses	The student develops and demonstrates a planned logical clear and well thought out approach to the solution of a complex task or problem.	The student develops and demonstrates a planned logical approach but must modify the methods and process to complete the task or problem.	The student develops an approach but lacks clarity and evidence of planning.	The approach taken by the student is disorganized, unclear, and haphazard with no logical sequence.	
Apply scientific principles to solve problems	Student effectively, logically, and appropriately incorporates the principles of science to solve problems.	Student incorporates the principles of science to solve problems.	Student attempts to incorporate the principles of science to solve problems.	No attempt is made to incorporate the principles of science to the problem at hand.	
Utilizes technology to organize and solve problems	The student always chooses the appropriate technology to successfully accomplish a task.	The student demonstrates the use of some appropriate technologies including various tools to successfully accomplish a task or solution.	The student demonstrates limited use of technologies to successfully accomplish a task or solution.	The student rarely demonstrates the use of technologies when solving problems or tasks.	

TRANSPORTATION / ROBOTICS
GRADES 9-12

RESOURCES

Transportation Energy and Power Technology, Glencoe-McGraw Hill Company
Career Room
Environmental Protection Agency
Federal Transportation Board

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: Introduction	X	
Unit 2: Safety	X	
Unit 3: Land Transportation	X	
Unit 4: Marine Transportation	X	X
Unit 5: Air Transportation		X
Unit 6: Space Transportation		X

ADVANCED TRANSPORTATION / ROBOTICS
GRADES 9-12

This course is a continuation of the introductory level course. This course is designed for the student who wants to explore in depth some of the realms or transportation addressed in Transportation/Robotics. The class will be a hands-on, problem solving experience for the students in lands, sea, and aerospace transportation. In land transportation, the student will design a vehicle with safety restraints that will keep the occupants safe during a 35-mph car crash. For sea transportation, students will build and test a submersible vessel to propel and surface on demand. Aerospace will focus on rocketry with guidance and various load-carrying capabilities with some relation to the Shuttle Program. This class will participate in the FIRST Robotics Competition.

Prerequisite: Completion of Transportation/Robotics with a B or better or instructor's approval

Credit: 0.5

ADVANCED TRANSPORTATION / ROBOTICS
GRADES 9-12

UNIT 1: SAFETY

Objectives
Students will define some of the safety concerns in a transportation lab.
Students will discuss personal responsibility for individual and group safety.
Students will indicate the locations of emergency stop buttons, exits, exit routes, eyewash station, first aid kit, and firefighting equipment.

Essential Questions
What are the dangers in performing transportation activities in the shop?
How can these dangers be reduced or eliminated?
Upon which trade or job position does responsibility lie for the safe performance, completion or quality of a given operation?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Safety is a personal and a group responsibility. Transportation technician is an occupation whose many dangers can be minimized with forethought and an appropriate attitude.	Practice emergency drills for fire and injury. Students will pass a prescribed safety instruction unit before using the lab, tools, or equipment. Instructor monitors continuously, and students practice mutual feedback for compliance with safety procedures.	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED TRANSPORTATION / ROBOTICS
GRADES 9-12

UNIT 2: LAND TRANSPORTATION I

Objectives

Students will explain how chemical energy is converted to electrical energy, in order to power a vehicle.
Students will explain how electrical energy is converted to chemical energy.
Students will design, build, and test an electric vehicle to travel at least 15 minutes before needing a recharge.
Students will mount a solar panel on an electric powered vehicle and calculate efficiency vs. an electric non-solar assisted car.
Students will research and write a report on test results for one of the new highbred vehicles being introduced into toady's automotive market.

Essential Questions

Are electric powered vehicles safe?
Are electric powered vehicles cost effective to the consumer?
How dependable are the new multi-energy source vehicles?
Where could solar powered vehicles be widely used?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Studying future trends is important to have control over our advancing technology.	Hybrid vehicle investigation/research. Presentation, data collection, discussion are strategies for this topic. Students will build and test a solar powered vehicle and observe how weather conditions affect operating efficiency.	Appropriate performance on student evaluation and/or classroom participation.
New technologies are tested for efficiency and feasibility.		
The growing concerns include economic gain, environmental damage, consumer satisfaction, and depletion of natural resources.		
Chemical energy can be stored and converted electrical energy.		

ADVANCED TRANSPORTATION / ROBOTICS
GRADES 9-12

UNIT 3: LAND TRANSPORTATION II

Objectives

Students will explain how efficiencies have improved from advances in technology.
Students will explain the process of converting chemical energy into electrical energy in a storage battery.
Students will explain how extreme temperatures affect a storage battery.
Students will explain how gearing improves efficiency on various types of vehicles.
Students will discuss how torque affects the performance of a vehicle.
Students will explain the welding processes used in the automobile industry.
Students will read measuring devices and lab test equipment accurately.
Students will identify errors and problems when testing.

Essential Questions

Are storage batteries safe?
Is cohesive bonding stronger than adhesive bonding?
What source of power produces high torque at various speeds?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
There is link between technology and economy, in which transportation plays a major role.	Classroom investigation: Given 20 pieces of material, determine the best method joining 2 pieces together. Ten joints required.	Appropriate performance on student evaluation and/or classroom participation.
Fusion bonding is a method to join two similar metals into one inseparable unit.	Test for strength: Test data report required.	
Power and torque are necessary for propulsion.	Design, build, and test a metal car frame to withstand a 5 mph crash test.	
Technology is providing many new methods to bond material.	Test data and report required.	

ADVANCED TRANSPORTATION / ROBOTICS
GRADES 9-12

UNIT 4: MARINE TRANSPORTATION

Objectives

Students will explain the importance of steam power on large ocean going vessels.
Students will explain how steam power is produced.
Students will explain the different propulsion systems and explain why there are many different varieties used today.
Students will discuss the career opportunities in developing newer and more efficient propulsion systems.
Students will compare several types of vessels and their propulsion systems.
Students will identify the most important waterways for large vessel travel.
Students will identify some of the important support systems for the marine transportation industry.

Essential Questions

What is the best hull shape for large vessels?
What fuel source is typically used to generate steam?
How does fluid pressure generate propulsion?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Research is the tool for advanced propulsion systems. Fluid power is used to transmit pressure. Fluid power circuits can be used to achieve mechanical advantages. When water is heated to produce pressurized steam, power can be generated. Steam is the power source on many large ships.	In addition to quizzes, tests, and class projects, students will also have a research project: • What type of propulsion system did the ocean liner TITANIC have? • What was the cost ton per mile? • Build a craft that will use pressure for propulsion. • Test and data report required.	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED TRANSPORTATION / ROBOTICS
GRADES 9-12

UNIT 5: AIR TRANSPORTATION

Objectives

Students will define Newton's third law of motion.
Students will explain how lightweight materials have increased aircraft efficiency.
Students will explain Bernoulli's principle, and its effect on flight.
Students will explain the importance of our air traffic control system.
Students will design a wing with a wing tip that would reduce vortex and increase lift.
Students will identify 3 weather conditions that could cause safety problems during flight.
Students will identify the cockpit instruments needed to fly an aircraft.
Students will explain the importance of wind tunnel testing.

Essential Questions

How does the air traffic control system work?
How does a jet engine produce thrust?
Why is vortex dangerous to other flying aircraft?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Air transportation systems have become a major system of human transportation. The aircraft wing is an airfoil that produces lift. Thrust is produced to create the required forward motion. The airport is a major support system in aircraft operation.	In addition to quizzes, tests, and class projects, the following performance assessments are recommended. • Aircraft industry investigation. Presentation, posters and class discussion. • Research Project. Howard Hughes and the Spruce Goose. • Students will design, construct, and fly a passenger airplane powered by a fuel-driven engine. • Test data and report required.	Appropriate performance on student evaluation and/or classroom participation.

ADVANCED TRANSPORTATION / ROBOTICS
GRADES 9-12

UNIT 6: SPACE TRANSPORTATION

Objectives

Students will identify several projects that help develop our space transportation program.
Students will define the term “near space’.
Students will explain how tasks are performed in a weightlessness environment.
Students will list several major benefits derived from the space program.
Students will describe how solid fuel rockets use a grain design to change thrust.
Students will explain how thrust produces directional motion in the shuttle program.
Students will define the term ‘gravity assist’.

Essential Questions

What space projects preceded the shuttle program?
What are two types of rockets used in today’s space transportation system?
How is space orbit achieved?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The shuttle program is the best example of space transportation.	In addition to tests, quizzes, and projects the following performance assessment is recommended. • Shuttle launch program. Presentation, posters, and discussions for this topic. • Simulate a shuttle launch starting with moving the shuttle onto the launch pad, fueling, weather conditions, safety checks, launch, and return from orbit.	Appropriate performance on student evaluation and/or classroom participation.
Many different forms of transportation are interrelated.		
Satellites are a very important part of our space program.		
Long term stays in a weightless environment may be harmful to humans.		

ADVANCED TRANSPORTATION / ROBOTICS
GRADES 9-12

UNIT 7: MAGNETIC LEVITATION (MAG-LEV) TRANSPORATION

Objectives
Students will define the concept of design.
Students will explain the concept of magnetism.
Students will explain different ways in which to increase the strength of a magnetic field.
Students will create a vehicle which relies on magnetic repulsion.
Students will explain MAG-LEV's impact on frictional losses found in a vehicle.

Essential Questions
How does a magnet work?
What is an electromagnet, and how can its strength be increased?
What effect does MAG-LEV have on the efficiency of a vehicle?
What are some other applications of MAG-LEV technologies?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A magnet is a charged piece of material which reacts positively or negatively with the earth's magnetic poles. Magnetism can be increases by the use of different magnetic materials, or through the use of an electromagnet. Since a MAG-LEV vehicle rides on a cushion of air, many of the frictional losses associated with gravitational forces on traditional transportation devices are reduced. MAG-LEV technologies are now being experimented with on weapons systems. (Rail Gun)	Students will design and build mag-level vehicle that will travel the track in the shortest time in a competition. Students will apply problem solving skills along with design skills successfully complete the project. Students will experiment with ways in which to increase the magnetic field in their vehicle.	Appropriate performance on student evaluation and classroom participation.

ADVANCED TRANSPORTATION / ROBOTICS
GRADES 9-12

RESOURCES

Transportation Energy and Power Technology, Glencoe-McGraw Hill Company
Career Room
Environmental Protection Agency
Federal Transportation Board

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: Safety	X	
Unit 2: Land Transportation I	X	
Unit 3: Land Transportation II	X	
Unit 4: Marine Transportation		X
Unit 5: Air Transportation		X
Unit 6: Space Transportation		X

STATE OF CONNECTICUT TECHNOLOGY EDUCATION STANDARDS

TRANSPORTATION TECHNOLOGY (GRADES 9-12)

TRAN.01	**Identify historical, social, economic, environmental, and government regulations impact transportation technology.**
TRAN.01.01	Demonstrate historical innovations in the evolution of transportation systems.
TRAN.01.02	Demonstrate how technological developments have changed how goods and people are transported
TRAN.01.03	Predict the social, economic and environmental impacts of existing and evolving transportation technologies.
TRAN.01.04	Describe the importance of transportation systems to maintaining our quality of life.
TRAN.01.05	Explain how governmental regulations impact transportation.
TRAN.02	**Define transportation technology systems.**
TRAN.02.01	Define and properly use common transportation technology terminology (e.g. combustion. pathways. velocity. vehicle. mode. payload. and terminal).
TRAN.02.02	Demonstrate and apply how propulsion, control, guidance, payload, and support systems for various land, water, space, air, and materials handling systems are used in transportation technologies.
TRAN.02.03	Demonstrate and apply basic applications for transportation technology (e.g. moving people. transporting goods. and recreation) and generate examples of each.
TRAN.02.04	Design, build and evaluate a simple fixed path or variable path transportation system.
TRAN.02.05	Solve a simple transportation problem by designing, building, and testing a vehicle that will carry a payload a specified distance.
TRAN.02.06	Describe and give examples on how transportation plays a vital role of other technologies including but not limited to manufacturing, construction, communications, health and safety and agriculture.
TRAN.02.07	Identify, design and apply and the uses of different energy and power technologies.
TRAN.02.08	Use design-based learning approaches that intentionally integrate the content and process of science and/or mathematics education with the content and process of technology and/or engineering education.

DRAFTING / CAD I
GRADES 9-12

This course is designed to introduce the student to drafting as a graphic language. Emphasis will be placed upon the elements within the language such as proper line work, lettering, dimensioning and measurement. Students will be exposed to two-dimensional drawing, Orthographic Projection, Isometric Projection, and will explore drafting techniques on a CAD system. The class will be taught from a hands-on, problem solving approach utilizing both the drafting machine and the computer as a communication tool.

Credit: 0.5

DRAFTING / CAD I
GRADES 9-12

UNIT 1: INTRO TO DRAFTING: THE DRAFTING LANGUAGE AND SKETCHING

Objectives

Students will recognize drafting as a form of communication, a graphic language, similar to written and spoken languages.
Students will list and explain the four goals of drafting.
Students will list and explain both the different disciplines of drafting, and the evolution of technology and design.
Students will explain the importance of sketching during design.
Students will relate how estimation and proportion are key elements to a quality sketch.
Students will describe the difference between "mechanical sketching" and "art".
Students will demonstrate proper technique while sketching an object.

Essential Questions

Why is drafting considered "graphic communication"?
How is the language of drafting similar to written words, or spoken language?
Why are neatness, speed, technique, accuracy, proportion, and estimation extremely important for proper effective graphic communication?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Drafting is a form of communication similar in many ways to spoken language. Learning to draft is similar to learning a foreign language.	Students will graphically communicate the drafting language through the generation of two freehand sketches utilizing proportion, accurate estimation, and neatness.	Appropriate performance on student evaluation.
Although there are many ways to communicate, communicating with pictures is sometimes the most efficient method.		
In contrast to "drawing", sketching is a mechanical process relying upon the use of estimation and proportion.		

DRAFTING / CAD I
GRADES 9-12

UNIT 2: LINES AND LETTERING

Objectives

Students will explain why using a predetermined style of line work and lettering is important within the drafting industry.
Students will recognize the difference between the ANSI lettering style and other common styles.
Students will describe why different line types are necessary in the drafting discipline.
Students will demonstrate proper technique while drawing numbers and letters.
Students will demonstrate proper technique while drawing various line types.

Essential Questions

Why is proper line work and lettering technique extremely important?
Why is a uniform style of line work and lettering adopted in the drafting discipline?
Why are some lines thicker or thinner than others?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The use of proper line work and lettering is crucial in order for a drawing to communicate effectively. Using proper line work and lettering is similar to using proper parts of speech in spoken language.	Students will demonstrate proper line work and lettering by first creating a title block, and then by adding to it a sample lettering exercise.	Appropriate performance on student evaluation and application of lettering on future drawings.
Uniformity with respect to line work and lettering conventions, allow a uniform “language” within the drafting community.		

DRAFTING / CAD I
GRADES 9-12

UNIT 3: BASIC MECHANICAL DRAWING

Objectives

Students will demonstrate proper use, care, and maintenance of the drafting machine.
Students will demonstrate proper care and use of common drafting instruments.
Students will explain the system used to grade drafting pencils.
Students will properly sharpen and point both a pencil and compass lead.
Students will maintain and clean an orderly work surface.
Students will set up a drawing paper using an appropriate layout configuration.
Students will accurately measure and layout components of two-dimensional drawings.

Essential Questions

Why are all drafts begun by first drawing an enclosing box consisting of the overall dimensions?
Why should the draftsman understand basic machine processes?
Why is proper technique crucial in the drafting discipline?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
In order for a drawing to communicate effectively, it must be neat and accurate, and must be drawn with proper technique.	Students will generate several two-dimensional drawings consisting of both linear as well as radial entities. Drawings will be evaluated on the proper use of lines, proper technique, accuracy, and neatness.	Appropriate performance on student evaluation and/or classroom participation.
Drafting is a discipline that relies upon technical processes, and not artistic ability in order to generate a final product.		
Principles learned in science and mathematics have a practical application to drafting.		

DRAFTING / CAD I
GRADES 9-12

UNIT 4: DIMENSIONING

Objectives
Students will explain the need for dimensioning on a drawing.
Students will list the types of lines needed for successful dimensioning.
Students will choose the appropriate pencil/lead for use in dimensioning.
Students will accurately place dimensions on a drawing.
Students will correctly apply numbers and text on a dimension line.
Students will describe how to place dimensions on features such as angles, circles, and arcs.

Essential Questions
Why do we draft objects, and what role does dimensioning play?
Why is it important to place only necessary dimensions and exclude unnecessary or "extra" ones?
Why are dimensioning lines so thin/fine?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The purpose of a drafted plan is to provide instruction while machining or constructing the design.	Students will properly apply dimensions to a drawing generated in class. Students will demonstrate proper technique in applying all linear, radial, and angular dimensioning forms.	Appropriate application of dimensions on future drawings.
In order for a drafted drawing to communicate effectively, it must possess necessary dimensions.		

DRAFTING / CAD I
GRADES 9-12

UNIT 5: ORTHOGRAPHIC PROJECTION

Objectives

Students will list the six basic views of an object, then explain the three most relevant ones.
Students will describe which dimensions are seen in each primary view.
Students will demonstrate how to set up an orthographic projection drawing.
Students will explain the use of a miter line.
Students will generate an orthographic projection drawing from two views of partial information.
Students will generate an orthographic projection drawing from a three-dimensional drawing.
Students will apply dimensions to an orthographic projection.
Students will explain the concept of "true size and shape".

Essential Questions

Does a two-dimensional object really exist?
How many sight planes does an object have? What are the three primary ones?
What is the purpose of a miter line?
What designates a sight plane as orthographic?
What must occur for a viewer to see an object both true size and true shape?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
All real objects are three-dimensional.	Students will generate several orthographic projection drawings showing the top, front, and right sides views of an object. The drawings may include special features such as inclined planes, oblique planes, circles and arcs, and hidden features. Dimensions must accompany the drawings.	Appropriate performance on student evaluation and/or classroom participation.
An object's dimensions are interrelated among its different views.		
An object can only be seen as true size and shape if the viewer's line of sight is perpendicular to the object's sight plane.		

DRAFTING / CAD I
GRADES 9-12

UNIT 6: ISOMETRIC PROJECTION

Objectives

Students will list three different types of pictorial drawings.
Students will explain isometric axis orientation.
Students will list steps in centering an isometric projection in the drawing space.
Students will describe "foreshortening" as it applies to a three-dimensional drawing.
Students will explain how circles and angles are affected in a pictorial drawing.
Students will properly set up and draw an isometric projection drawing both from sample pictorial drawings as well as from an orthographic projection.

Essential Questions

What is the purpose of pictorial drawings in industry?
What designates a pictorial drawing as an isometric, an oblique, or a perspective drawing?
What effect does foreshortening have on an object's true size and true shape?
Why are radial lines drawn as ellipses, and not as true circles in isometric projection?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Three-dimensional drawings are primarily used in the design field to provide a pictorial representation of an object.	Students will generate several isometric projection drawings of objects including such features as inclined planes, oblique planes, and radii. Students must demonstrate geometric construction principles regarding isometric construction, as well as use of templates.	Appropriate performance on student evaluation and/or classroom participation.
Any three-dimensional drawing consists of the three primary views of the object.		
A pictorial drawing never represents the true size and true shape of an object.		

DRAFTING / CAD I
GRADES 9-12

UNIT 7: INTRODUCTION TO COMPUTER AIDED DRAFTING

Objectives

Students will list the different parts of a P.C.
Students will explain the function of the computer for use in CAD/CAM operations.
Students will successfully open and manipulate the CAD program using basic functions.
Students will output drawings from an electronic interface to a physical medium.
Students will generate both part and pattern files using the CAD system.
Students will demonstrate proper drafting technique on the CAD platform.

Essential Questions

What advantages does CAD have when compared to board drafting?
What is CADD/CAM? What effect has it had on manufacturing?
How can one apply CAD skills acquired in high school?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Through the use of computers, accuracy in drafting is only limited by the accuracy of the output devices.	Students will produce basic CAD (Computer Aided Drafting) drawings such as a title block and other two-dimensional objects, implementing elementary CAD operations. Students must demonstrate proper technique including creating entities, choosing appropriate line types and colors, and importing and exporting files.	Appropriate performance when introduced to CAD in future classes.
Computers allow the draftsman to more easily view, reproduce, and manipulate designs.		

DRAFTING / CAD I
GRADES 9-12

DRAFTING / CAD I RUBRIC

Name: _____ Class: _____ Date: _____

	A (95)	B (85)	C (75)	D (65)	F (55)
Comprehension of Plan	The student is able to masterfully follow and analyze a written plan to perform project.	The student is able to accurately follow and analyze a written plan to perform a project.	The student is able to follow and analyze a written plan to perform a project.	The student is occasionally able to follow and analyze a written plan to perform a project.	The student is not able to follow and analyze a written plan to perform a project.
Application of Math	The student chooses effective and appropriate mathematic strategies to solve problems.	The student chooses appropriate mathematic strategies to solve problems.	The student chooses mathematic strategies to solve problems.	The student attempts to choose mathematic strategies to solve problems.	The student makes little to no attempt to use mathematic strategies to solve problems.
Problem Solving	The student shows exceptional thinking skills to identify and solve a problem.	The student shows advanced thinking skills to identify and solve a problem.	The student shows adequate thinking skills to identify and solve a problem.	The student shows minimal thinking skills to identify and solve a problem.	The student is unable to solve a problem.
Application of Technical Skill	The student masterfully applies the technical skills needed to create a product.	The student successfully applies the technical skills needed to create a product.	The student applies the technical skills needed to create a product.	The student attempts to apply the technical skills needed to create a product.	The student does not apply the technical skills needed to create a product.

DRAFTING / CAD I
GRADES 9-12

RESOURCES

Basic Technical Drawing, H. Spencer and J. Dygdon, Glencoe, New York.

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: Intro to Drafting: The Drafting Language and Sketching	X	
Unit 2: Lines and Lettering	X	
Unit 3: Basic Mechanical Drawing	X	
Unit 4: Dimensioning	X	
Unit 5: Orthographic Projection		X
Unit 6: Isometric Projection		X
Unit 7: Introduction to Computer Aided Drafting		X

DRAFTING / CAD II
GRADES 10-12

This course is designed for students that have shown an interest in the drafting field. Instruction will be given in creating different types of two- and three-dimensional drawings, geometric constructions, auxiliary drawings, sectional drawings, developments, and marine drafting, utilizing both the CAD system and drafting machine. Students will be taught from a hands-on, problem-solving approach. This class is open to students in grades 10, 11, and 12.

Prerequisite: Completion of Drafting/CAD I with a C or better

Credit: 1.0

DRAFTING / CAD II
GRADES 10-12

UNIT 1: GEOMETRIC CONSTRUCTION

Objectives

Students will recognize the methods and practices of basic geometric construction.
Students will define the relationship among drafting, geometry, and trigonometry.
Students will define different geometric terms such as parallel, tangent, concentric, etc.
Students will apply several different types of basic geometric constructions to board drafting problems.
Students will perform more complex geometric constructions using the CAD system.
Students will explain the use of the computer as a time saving drafting tool.

Essential Questions

How related are geometry and drafting/CAD?
If a CAD system is able to perform geometric constructions quickly and accurately, why then is it still important to learn to construct them manually?
What tools are necessary if one wants to perform basic geometric constructions?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Principles of geometry apply to drafting on a daily basis.	The students will solve several geometric construction problems utilizing basic geometric principles. Students will be evaluated on their solution's accuracy and their application of various geometric principles.	Generation of two drawings consisting of twelve different geometric constructions.
The ability to apply basic geometric postulates and theorems to drafting is a necessary skill.		
Basic skills learned in mathematics are necessary and easily applied to problems encountered in everyday life.		
The computer can save the draftsman time by performing complex geometric constructions automatically.		

DRAFTING / CAD II
GRADES 10-12

UNIT 2: REORIENTATION TO CAD AND MECHANICAL DRAWING

Objectives

Students will explain different components of a PC system including: Hardware, software, input device, output device, and operating system.
Students will manipulate the CAD system.
Students will explain the use of the CAD terminals as a time-saving drafting tool.
Students will explain the effect which CAD has had on current events, world issues, and problem solving.
Students will create both part and pattern files for title blocks.
Students will generate complex two-dimensional drawings utilizing the CAD system and the Cartesian coordinate system..
Students will categorize different parts of the drawing by the use of different line types, thickness, and color.
Students will transfer the CAD drawing from an electronic platform to a physical medium, as well as through a network, while using multiple file formats.

Essential Questions

Why are CAD stations used in industry?
What degree of accuracy can a CAD system achieve?
What is the role CADD/CAM in today's manufacturing industry?
In what ways does CAD differ from board drafting? In what ways is it similar?
How and why is color used on the CAD system?
Why are different file formats used in today's computing?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Through the use of computers, a drawing's accuracy is limited only by the accuracy of the output devices used.	Students will generate advanced two-dimensional CAD drawings. Students will demonstrate competence in drawing linear and radial entities, changing attributes of entities, performing geometric constructions, and generating hard copies of drawings.	Students will manipulate various applications within the CAD program. Students will finally use what they have learned to generate their first drawing.
Computers allow the draftsman to more easily view, reproduce, and manipulate designs.		
In order for a drawing to communicate effectively, it must be neat and accurate, and must be drawn with proper technique.		
The computer is only a tool by which drawings are generated. A well-trained draftsman is still the most important component in the drafting discipline.		

DRAFTING / CAD II
GRADES 10-12
UNIT 3: DIMENSIONING ON CAD

Objectives

Students will explain the need for dimensioning an object.
Students will explain the nomenclature used when dimensioning.
Students will differentiate among the different styles of dimensions.
Students will differentiate between Tolerancing and Geometric Tolerancing
Students will manipulate the CAD system in order to place dimensions on a drawing.
Students will describe the order in which dimensions are placed on an object.
Students will correctly dimension a teacher-provided tutorial including all linear, angular, and radial dimensions.
Students will apply dimensions to any CAD drawing.

Essential Questions

Why do we draft parts, machinery, and structures?
Why is it important to have a uniform dimensioning "language" in the drafting industry?
How will proper, or improper, dimensioning effect CAM operations?
What type of drawings, if any, would not require dimensions?
Why are tight tolerances critical to today's manufacturing?
How do geometric tolerances help to explain and eliminate clutter on a drafted plan?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The purpose of a drafted plan is to provide instruction while machining or constructing the design.	The students will properly apply dimensions such as linear, radial, and angular dimensions, as well as notes, to a pre-existing tutorial drawing. After completing the tutorial, students will apply dimensions to all future drawings.	Appropriate dimensions will be applied to all drawings.
In order for a drafted drawing to communicate properly, it must possess necessary dimensions.		
Tolerances provided by the draftsman maintain design parameters by the machinist or manufacturer.		

DRAFTING / CAD II
GRADES 10-12

UNIT 4: AUXILIARY DRAWINGS

Objectives

Students will recognize the need for an auxiliary view as a supplemental detail drawing.
Students will explain why only a perpendicular line of sight will allow the viewer to see the true size and true shape of an object's plane.
Students will demonstrate the ability to produce both parallel and radial auxiliary drawings.
Students will properly dimension an auxiliary drawing.

Essential Questions

From what perspective is an inclined plane drawn true size and true shape?
What purpose does an object's auxiliary view serve?
Why do we avoid placing dimensions on an auxiliary drawing?
What type of drawing would not require an auxiliary drawing?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The only manner in which to view a true size and true shape of an objects' plane is to keep the line of sight to it perpendicular. If the line of sight is anything other than 90 degrees, foreshortening occurs, skewing the object's true size and shape.	The students will demonstrate several auxiliary drawings, describing both parallel and radial developments. Proper dimensioning must accompany these drawings.	Appropriate performance on student drawings and in-class evaluations.
Detail drawings are sometimes necessary to help define special features not on an object's primary sight planes.		

DRAFTING / CAD II
GRADES 10-12

UNIT 5: PATTERN DEVELOPMENT

Objectives

Students will identify the four basic solids: Prism, cylinder, cone, pyramid.
Students will demonstrate the "stretchout" of identified shapes using proper drafting techniques.
Students will apply auxiliary views of angular surfaces of a solid in order to create a complete pattern of it.
Students will construct various three-dimensional objects from student-generated patterns.
Students will apply dimensions to pattern development drawings.

Essential Questions

In what shapes are the four basic solids?
Can any solid be transformed into a stretched-out, two-dimensional pattern?
What is the importance of the "stretchout line"?
What role do development drawings have in manufacturing?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The ability to turn a three dimensional object into a pattern is an important skill for anyone who performs fabrication processes.	The students will generate several pattern development drawings based upon theory learned in class. Students will produce both parallel and radial line developments with all necessary dimensions. When asked, students will create physical three-dimensional models of the drafted pieces.	Students will create actual 3-D solids from patterns drawn on the CAD system, then printed.
A pattern is one drawing which will show the true size and true shape of all facets of an object, no matter their orientation when constructed.		
A pattern development can be used to make a working, three-dimensional model of any part that is designed.		

DRAFTING / CAD II
GRADES 10-12

UNIT 6: SECTIONAL VIEWS

Objectives
Students will identify and properly draw section lines and define a cutting plane.
Students will describe common sectioning procedures such as full sections, half sections, offset sections, and revolved sections.
Students will generate various sectional drawings utilizing proper technique.
Students will apply dimensioning to sectional drawings.

Essential Questions
Why would a completed set of plans include a sectional view?
Why are hidden lines not shown in a sectional view?
Why does the draftsman implement revolved or offset sections?
What is the purpose of the Cutting Plane Line?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Manufactured objects typically have internal features that cannot be shown effectively with a typical view.	The students will produce basic sectional views of assorted objects. Students will generate properly dimensioned full sections, half sections, offset sections, and revolved section drawings.	Appropriate performance on assigned drawings.
Any object can be "graphically dissected" in order to describe all internal and external features of an object, as well as from which material it is constructed.		

DRAFTING / CAD II
GRADES 10-12

UNIT 7: PICTORIAL DRAWINGS / THREE-DIMENSIONAL SOLID MODELING

Objectives

Students will identify the six basic views of an object.
Students will manipulate the CAD system in order to see all views both separately, then simultaneously.
Students will extrude a three-dimensional wireframe model from the three primary views.
Students will demonstrate how to add circular features into a wireframe model.
Students will create an electronically generated layout showing the three primary views and a pictorial representation.
Students will generate a rendered image from a wireframe model.
Students will define "working drawing".
Students will demonstrate how to manipulate a construction plane.
Students will create an assembly drawing.

Essential Questions

What is the relationship among the Front, Top, and Right Side views of an object?
How does pictorial image generation differ on a board as compared to a CAD system?
What is meant by "solid modeling"?
Why are finished pictorial drawings usually rendered?
What type of pictorial drawing is most appropriate when viewing a complex part consisting of many components?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Pictorial drawings are primarily used to help the reader visualize the drafted entity.	The students will generate several pictorial drawings in isometric projection, using the CAD system. At least one drawing will be of an object that each student brings into class (with teacher approval). Students will produce both a wireframe model as well as a fully rendered image.	Appropriate performance on student evaluation and/or classroom participation.
The CAD system allows wireframe, three-dimensional models, to be created from any primary view.		
An assembly drawing allows the viewer to see not only the part, but also how its components fit together		
Computer rendering of a three-dimensional object adds the element of realism to pictorial drawings.		

DRAFTING / CAD II
GRADES 10-12

UNIT 8: MARINE DRAFTING

Objectives

Students will define basic lofting terms such as: Sheer, chine, deck, bow, stern, transom, etc.
Students will describe what factors most greatly influence a boat's design and function.
Students will relate and explain the two basic categories of boat hull designs: Planing and displacement.
Students will demonstrate the ability to generate a drawing of a vessel using baseline and half-width data tables.
Students will demonstrate the ability to generate a sectional-frame drawing from any station in a boat's hull design.
Students will demonstrate proper dimensioning form.
Students will construct a scale model of a vessel utilizing a student-generated design and assorted construction materials.

Essential Questions

What is meant by "lofting"?
How important is the sheer line to a boat's form and function?
What is the relationship among the baseline, centerline, "heights to", and "half width" measurements?
Why should a sectional drawing of a boat's rib section be provided with a completed set of plans?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The sheer line and hull shape of a boat's design are the two greatest factors influencing its form and function.	The students will draft/loft a boat design as supplied by the instructor. The students' drawings will include primary views of the boat from three perspectives, as well as a rib sectional. The students will then have the opportunity to draft a fully rigged view of the vessel.	Appropriate performance on student evaluation and/or classroom participation.
All boat and ship designs are generated from the same basic lofting principles.		
Our area of the country has been greatly influenced by the boat design and boat building trades for generations.		

DRAFTING / CAD II
GRADES 10-12

DRAFTING / CAD II RUBRIC

Name: _____ Class: _____ Date: _____

	A (95)	B (85)	C (75)	D (65)	F (55)
Comprehension of Plan	The student is able to masterfully follow and analyze a written plan to perform project.	The student is able to accurately follow and analyze a written plan to perform a project.	The student is able to follow and analyze a written plan to perform a project.	The student is occasionally able to follow and analyze a written plan to perform a project.	The student is not able to follow and analyze a written plan to perform a project.
Application of Math	The student chooses effective and appropriate mathematic strategies to solve problems.	The student chooses appropriate mathematic strategies to solve problems.	The student chooses mathematic strategies to solve problems.	The student attempts to choose mathematic strategies to solve problems.	The student makes little to no attempt to use mathematic strategies to solve problems.
Problem Solving	The student shows exceptional thinking skills to identify and solve a problem.	The student shows advanced thinking skills to identify and solve a problem.	The student shows adequate thinking skills to identify and solve a problem.	The student shows minimal thinking skills to identify and solve a problem.	The student is unable to solve a problem.
Application of Technical Skill	The student masterfully applies the technical skills needed to create a product.	The student successfully applies the technical skills needed to create a product.	The student applies the technical skills needed to create a product.	The student attempts to apply the technical skills needed to create a product.	The student does not apply the technical skills needed to create a product.

DRAFTING / CAD II
GRADES 10-12

RESOURCES

Basic Technical Drawing, Spencer, H. and Dygdon, J. Glencoe, New York.
Technical Drawing Fundamentals – CAD – Design, Goetsch, D., Nelson, J., and Chalk, W. Delmar, New York.

PACING GUIDE

Unit	Semester 1	Semester 2
Unit 1: Geometric Construction	X	
Unit 2: Reorientation to CAD and Mechanical Drawing	X	
Unit 3: Dimensioning on CAD	X	
Unit 4: Auxiliary Drawings	X	
Unit 5: Pattern Development	X	X
Unit 6: Sectional Views		X
Unit 7: Pictorial Drawings / Three-Dimensional Solid Modeling		X
Unit 8: Marine Drafting		X

ARCHITECTURAL DRAFTING / CAD
GRADES 11-12

This course is for the student who has shown an interest in drafting and CAD, and would like further his/her knowledge in that area. The student in this course will be introduced to construction theories, architectural sectional drawings, architectural floor and site planning/design, and architectural CAD. In addition, the student may be instructed in the use of the builder's level and transit. Students will be taught from a hands-on, problem-solving approach. This class is open to students in grades 11 and 12.

Prerequisite: Completion of Drafting/CAD II with a C or better OR any senior who has completed Drafting I with a C or better.

Credit: 1.0

ARCHITECTURAL DRAFTING / CAD
GRADES 11-12

UNIT 1: INTRODUCTION/THREADS AND FASTENERS

Objectives

Students will identify the difference between an external and internal thread.
Students will list and define screw thread terms such as root, crest, pitch, and major diameter.
Students will explain the difference among such thread forms as NC, NF, Square, and ACME.
Students will interpret and generate a standardized thread note.
Students will generate drawings of common screw thread forms.

Essential Questions

Why are threaded fasteners used as semi-permanent fastening devices in high stress applications?
What is the relationship between TPI (Threads per Inch), and pitch?
What does the thread note, 7/8 x 4 ¼ - 9NC-2 LH, represent?
In what application would one utilize a fine thread as opposed to a coarse thread? A left-hand thread as opposed to a right-hand thread

Knowledge and Skills	Instructional Strategies	Evidence of Learning
An understanding of fasteners and fastener nomenclature is a valuable and practical life skill.	The student will generate several thread drawings including sectional drawings describing thread forms, pitch, and thread nomenclature.	Use of appropriate nomenclature and thread construction techniques on a variety of thread forms.
Fastener designs are standardized throughout the world.		
Many different thread types exist, each with their particular application.		

ARCHITECTURAL DRAFTING / CAD
GRADES 11-12

UNIT 2: INTRO TO ARCHITECTURAL SECTIONAL DRAWINGS: WALLS

Objectives

Students will identify historical events and trends that have influenced architecture.
Students will explain how cultural and environmental conditions have impacted global architecture.
Students will list and explain the components in a typical wood frame wall.
Students will explain why an architect must possess a working understanding of physics and material analysis.
Students will explain how the different components in a frame wall are fastened.
Students will differentiate between "finished" and "rough" openings.
Students will explain the effect building code has upon today's construction practices.
Students will generate a scaled, complex, two-dimensional section drawing showing component parts of a typical frame wall.

Essential Questions

Why do wood frame walls utilize a spacing of 16" or 24" C.C?
Why is wall layout usually performed by the most experienced carpenter on the jobsite?
How are window and door rough openings similar? How are they different?
Why is it important for an architect to understand construction theory?
What effect do material properties have on the application of that material?
What effect does building code have on frame wall construction?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
All wood frame walls used in construction today follow the same basic design with respect to intersections, door and window openings, as well as dimensions.	Students will create two different wall sectional drawings based upon construction theory learned in class. The drawings will contain examples of all wall components, their connection to one another, and finally, will be drawn to applicable building code.	Appropriate application of architectural processes on future drawings.
The wall's dimension is not only required for structural stability, but also to house wall components such as insulation, windows, doors and outlet/switch boxes.		
Detail drawings are not only an important component of any finished set of architectural plans, but are also required by building inspectors.		
Adherence to local, state, and national building codes not only standardizes construction, but also increases occupant safety.		

ARCHITECTURAL DRAFTING / CAD
GRADES 11-12

UNIT 3: ARCHITECTURAL SECTIONAL DRAWINGS: FOUNDATION AND FLOOR FRAME

Objectives

Students will list and define the parts of a basic foundation and floor frame system.
Students will explain how footing surface area, soil mechanics, and material properties can affect the load capacity of a structure.
Students will list ways in which a floor frame can be attached to a foundation.
Students will explain the drainage characteristics of different soil types.
Students will generate a section drawing showing component parts of a typical concrete foundation and floor frame.
Students will list the components of concrete.

Essential Questions

Why do we pour a footing at the base of a foundation wall?
When would a footing not be necessary?
Why is concrete used as a foundation material?
How can we prevent basement leaks?
How is the floor frame attached to the foundation?
What is meant by an "embedded" anchor?
What are the two reasons why a subfloor is installed over a floor frame?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The foundation is the structure's link with the earth.	The students will create a foundation and floor frame sectional showing all components, how they are constructed, and dimensioned. The sectional drawing shall be drawn in accordance with building code.	Appropriate performance on student evaluation and/or classroom participation.
If foundation is not placed on unmolested soil, then settling and foundation failure is imminent.		
Frost line can vary from geographic locations; building below it will ensure a stable foundation.		
Framing a floor follows many of the same criteria as framing a wall.		

ARCHITECTURAL DRAFTING / CAD
GRADES 11-12

UNIT 4: ARCHITECTURAL SECTIONAL DRAWINGS: ROOF SYSTEM

Objectives

Students will define triangulation, and explain how it relates to the roof system.
Students will differentiate between the two types of roof systems and give advantages/disadvantages of each.
Students will relate the importance of roof pitch in a home design.
Students will perform basic roof pitch calculations.
Students will define and explain the need for roof overhang.
Students will generate a basic roof sectional drawing.

Essential Questions

Why is a roof system based on the shape of a triangle?
Why would one choose a trussed roof system? A rafter roof system?
What factors would affect the designer's choice of roof pitch?
Why is roof overhang important to design into a structure?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The theory of triangulation defines the strength and structural integrity of the typical roof system.	The students will create a roof sectional drawing based on a given set of parameters. The design must contain all component parts of a roof system, and be drawn in accordance with building code.	Appropriate performance on student evaluation and/or classroom participation.
Roof systems can be categorized into two categories: The traditional rafter system and the trussed roof system.		
The pitch of a roof can affect not only the aesthetics of a home design, but also its ability to withstand severe weather conditions.		

ARCHITECTURAL DRAFTING / CAD
GRADES 11-12
UNIT 5: ARCHITECTURAL PLANS

Objectives

Students will define the role of the architect.
Students will demonstrate proper use of architectural drafting equipment.
Students will design a floor plan relative to sleeping, living, and service areas, and traffic flow.
Students will demonstrate elements of architectural design.
Students will demonstrate sequence in drawing a floor plan.
Students will generate an accurate foundation plan, including footings and cutouts.
Students will identify the relationship of elevation drawings to floor plans.
Students will generate an elevation drawing.
Students will describe the components involved in and the importance of a plot plan.
Students will design plans relating how a house must fit on a particular lot with inherent limitations.
Students will generate completed set of plans showing all components of the floor plans and their relationship to one another.
Students will generate a window and door schedule to accompany a house plan.
Students will perform a cursory cost estimation on house design.

Essential Questions

What is the architect's role in the design and drafting of home plans?
Why is a working knowledge of construction theory and building codes necessary in order to design a practical set of home plans?
How important is sketching/brainstorming to the architect?
What effect will the site have on a home's design?
What factors must be considered when designing service areas and living areas?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Mistakes made during the planning stage of building's design can have far-reaching effects on the structure's appearance, efficiency, and ease of construction.	Students will design and draft a Ranch style house. Plans will include the following: Floor plans, dimensions, fixtures and furniture, windows, doors, foundation plan, window and door schedule, site plan, and elevations. The house will be designed in accordance with applicable building code.	Appropriate performance on student evaluation and/or classroom participation.
Knowledge of construction principles is necessary to ensure a practical, efficient, and aesthetically pleasing design.		
Several different types of plans are necessary to effectively communicate the designer's ideas to the customer, contractor, and inspector.		
Room location, size, and layout, in addition to traffic flow patterns are factors that greatly affect a home design's effectiveness.		
A plan's design must adhere to standardized local, state, and national building codes.		

ARCHITECTURAL DRAFTING / CAD
GRADES 11-12

ARCHITECTURAL DRAFTING / CAD RUBRIC

Name: _____ Class: _____ Date: _____

	A (95)	B (85)	C (75)	D (65)	F (55)
Comprehension of Plan	The student is able to masterfully follow and analyze a written plan to perform project.	The student is able to accurately follow and analyze a written plan to perform a project.	The student is able to follow and analyze a written plan to perform a project.	The student is occasionally able to follow and analyze a written plan to perform a project.	The student is not able to follow and analyze a written plan to perform a project.
Application of Math	The student chooses effective and appropriate mathematic strategies to solve problems.	The student chooses appropriate mathematic strategies to solve problems.	The student chooses mathematic strategies to solve problems.	The student attempts to choose mathematic strategies to solve problems.	The student makes little to no attempt to use mathematic strategies to solve problems.
Problem Solving	The student shows exceptional thinking skills to identify and solve a problem.	The student shows advanced thinking skills to identify and solve a problem.	The student shows adequate thinking skills to identify and solve a problem.	The student shows minimal thinking skills to identify and solve a problem.	The student is unable to solve a problem.
Application of Technical Skill	The student masterfully applies the technical skills needed to create a product.	The student successfully applies the technical skills needed to create a product.	The student applies the technical skills needed to create a product.	The student attempts to apply the technical skills needed to create a product.	The student does not apply the technical skills needed to create a product.

ARCHITECTURAL DRAFTING / CAD
GRADES 11-12

RESOURCES

Basic Technical Drawing, Spencer, H. and Dygdon, J. Glencoe, New York.
Architecture, Residential Drawing and Design, Kicklighter, C.E. Delmar, New York.

PACING GUIDE

Unit	Semester 1	Semester 2
Unit 1: Introduction / Threads and Fasteners	X	
Unit 2: Architectural Sectional Drawings: Walls	X	
Unit 3: Architectural Sectional Drawings: Foundation and Floor Frame	X	
Unit 4: Architectural Sectional Drawings: Roof System	X	
Unit 5: Architectural Plans		X

ADVANCED DRAFTING / CAD
GRADE 12

This course is for the student who has demonstrated both interest and skill in the Drafting and CAD area. This class provides the student with the opportunity to apply acquired drafting skills to real-world problems in our community. Students should expect to work on an independent project which should provide challenges and practical experience. Students will be taught from a hands-on, problem solving approach. This class is open only to seniors.

Prerequisite: Successful completion of Drafting/CAD II AND Architectural Drawing

Credit: 1.0

ADVANCED DRAFTING / CAD
GRADE 12

UNIT 1: COMPUTER AIDED ARCHITECTURAL DRAFTING

Objectives

Students will generate sketches of a two-story home design.
Students will determine a floor plan relative to sleeping, living and service areas, and traffic flow.
Students will demonstrate proper elements of architectural design.
Students will participate in necessary revision cycles and evaluation.
Students will set up a drawing template within the CAD system including segregated layers.
Students will generate a set of plans on the CAD system including the following: Walls, doors, windows, floor framing, staircases, roof, foundation, fixtures, and dimensions.
Students will perform walk-through and rendering functions as necessary.
Students will output a completed set of plans including: Floor plans, dimensioning, foundation plans, schedule, and three-dimensional pictorials.
Students will generate prints from the master plan.

Essential Questions

Why is it still extremely important to produce a sketch of a design before drafting it on a CAD system?
Why is a working knowledge of construction theory and building codes necessary in order to design a practical set of home plans?
What effect will the site have on a home's design?
What factors must be considered when designing service areas and living areas?
How does the computer-aided draftsman utilize layers on the CAD program?
What is the difference between Cartesian and polar coordinates?
Why have most drafting firms switched to the CAD platform?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Using a computer can increase the accuracy and speed of plan generation.	The student will set up and draft a plan of a provided home design, using ChiefArchitect. The final drawing must contain separate layers for all plan components, in addition to a rendered pictorial layer. Final plans must be plotted.	Appropriate performance on student-paced engineering and architectural drawings.
Architectural CAD software packages design structures in a three-dimensional, wireframe layout.		
CAD software allows the architect to not only design a structure, but also to perform computer-generated walk-through and rendered perspectives.		

ADVANCED DRAFTING / CAD
GRADE 12

UNIT 2: FORMAL ADOPTION OF CAPSTONE PROJECT WITH PROPOSAL AND TIMELINE

Objectives

Students will choose an appropriate topic for their capstone.
Students will explain the importance of a problem's statement and definition.
Students will list and explain the elements of an effective proposal.
Students will explain the importance of a timeline and adherence to it.
Students will explain the process in which changes may be made to a proposal once accepted.
Students will define personal accountability, and how it relates to this project.

Essential Questions

What advantages are there to defining the problem before a plan is adopted to solve it?
Why is a proposal drafted?
How will a worker keep focused, motivated, and on schedule throughout the process?
If any changes are required in the design of the proposal after project initiation, what steps must be taken?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The ability to define and state a problem, and give an accurate plan to solve and/or complete the problem is a necessary, useful life-long skill.	Based on set parameters, the student will choose a capstone project which will use utilize drafting skills learned during the past three years in class. The student will draft a written proposal, define how s/he will complete this project, provide resources to be used (inside as well as outside the classroom), and finally a written timeline.	Appropriate formation and defense of a technological proposal.
After defining a problem, it must be stated formally in a written proposal, containing a statement of the problem, solutions, possible resources, and timeline.		
Whatever work that is used to help solve the problem at hand must follow the terms and conditions defined in the proposal, or an amendment must be drafted.		
Independent work must continually be monitored by the participant, and corrections implemented.		

ADVANCED DRAFTING / CAD
GRADE 12
UNIT 3: THE STATUS REPORT

Objectives
Students will list and explain elements found in a status report.
Students will explain why solutions for unexpected problem must always accompany the status report.
Students will explain why clear and concise language must be used in a status report.
Students will write and present a status report on their Capstone Project at regular intervals.

Essential Questions
While working independently, why must a worker still maintain communication with a supervisor?
What information must be reported on a continual basis?
Why is it important to report at pre-determined intervals? At random intervals?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
While working independently on a project, a worker must continually keep his/her supervisor aware of the progress.	Throughout the duration of their Capstone Project, the student must maintain formal communication with their teacher. The status of the project, adherence to the projected timeline, and problems with solutions must be addresses. To this end, each student must draft and present a status report to the instructor at regularly scheduled intervals.	Appropriate performance when providing the instructor with either a written or oral status report.
If problems are reported to a supervisor, possible solutions to those problems must accompany the report.		
The project's timeline must always be considered when reporting on the project's status.		

ADVANCED DRAFTING / CAD
GRADE 12

UNIT 4: PRESENTATION OF THE FINAL PROJECT

Objectives
Students will explain the importance of thorough preparation and presentation.
Students will utilize different types of media in a presentation.
Students will define the concept of professionalism, and apply it to their presentation.
Students will present their Capstone Project in a logical and coherent manner.

Essential Questions
How does professionalism affect the outcome of the presentation?
Why should the presenter organize his presentation around the original proposal?
How is a final presentation similar to "closing arguments" in a court case?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Time must be invested to prepare for a presentation.	The student will organize and present all the work done on their Capstone Project to date, utilizing one of or several different electronic and/or graphic mediums. The presentation should include a statement of the original problem, research conducted, resources used, problems encountered, solutions discovered, and finally what was learned in the process.	Creation of a complete and bound final project including all parts discussed and agreed upon in the initial proposal.
The presentation must be appealing, interesting, focused, and professional.		
The presentation is the student's last chance to showcase and justify all work done. It must satisfy procedures outlined in the original proposal, or its amendments.		

ADVANCED DRAFTING / CAD
GRADE 12

ADVANCED DRAFTING / CAD RUBRIC

Name: _____ Class: _____ Date: _____

	A (95)	B (85)	C (75)	D (65)	F (55)
Comprehension of Plan	The student is able to masterfully follow and analyze a written plan to perform project.	The student is able to accurately follow and analyze a written plan to perform a project.	The student is able to follow and analyze a written plan to perform a project.	The student is occasionally able to follow and analyze a written plan to perform a project.	The student is not able to follow and analyze a written plan to perform a project.
Application of Math	The student chooses effective and appropriate mathematic strategies to solve problems.	The student chooses appropriate mathematic strategies to solve problems.	The student chooses mathematic strategies to solve problems.	The student attempts to choose mathematic strategies to solve problems.	The student makes little to no attempt to use mathematic strategies to solve problems.
Problem Solving	The student shows exceptional thinking skills to identify and solve a problem.	The student shows advanced thinking skills to identify and solve a problem.	The student shows adequate thinking skills to identify and solve a problem.	The student shows minimal thinking skills to identify and solve a problem.	The student is unable to solve a problem.
Application of Technical Skill	The student masterfully applies the technical skills needed to create a product.	The student successfully applies the technical skills needed to create a product.	The student applies the technical skills needed to create a product.	The student attempts to apply the technical skills needed to create a product.	The student does not apply the technical skills needed to create a product.

ADVANCED DRAFTING / CAD
GRADE 12

RESOURCES

Basic Technical Drawing, Spencer, H. and Dygdon, J. Glencoe, New York.
Architecture, Residential Drawing and Design, Kicklighter, C.E. Delmar, New York.

PACING GUIDE

Unit	Semester 1	Semester 2
Unit 1: Computer Aided Architectural Drafting	X	
Unit 2: Formal Adoption of Capstone Project with Proposal and Timeline	X	
Unit 3: The Status Report	X	>
Unit 4: Presentation of the Final Project		X

CONSTRUCTION ENGINEERING
GRADES 9-12

This course will cover basic construction principles and practices. Emphasis will be placed on design, geometric theories, construction, and evaluation/testing. Some projects may include bridges, roof trusses, cantilever beams, geodesic domes, residential wall framing, towers, pneumatic structures, and concrete work. This class will be taught from a hands-on, problem solving approach.

Credit: 0.5

CONSTRUCTION ENGINEERING
GRADES 9-12

UNIT 1: INTRODUCTION TO CONSTRUCTION MATERIALS AND PROPERTIES

Objectives

Students will define the concept of Construction.
Students will explain the impact which construction has had on society, the economy, and history.
Students will identify the different realms of engineering including but not limited to: Mechanical, Civil, Electrical, and Chemical.
Students will define the engineer's role, in R&D, Design, Production, Testing, and Supervision.
Students will identify different types of materials used in construction such as wood, ceramics, metals, and plastics.
Students will describe where certain materials are used in construction and for which applications.
Students will explain different stresses that a material can undergo.
Students will list and explain material properties such as tension, compression, elasticity, plasticity, toughness, fatigue, shear, and creep.
Students will explore the job outlook and requirements for a career in engineering.

Essential Questions

What is the role of the engineer? How is his/her role related to the tradesperson?
How has construction changed over time? How has it stayed the same?
How do the different realms of engineering differ?
What effect does a material's properties have on its application in construction?
What are some outcomes resulting from faulty engineering?
What are some methods used today to test various materials?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Improvements in construction have allowed us to improve our quality of life.	Students will perform a materials' properties lab in which they will test various materials such as wood, metal, and plastic and then analyze their properties. These properties may include tension, compression, elasticity, plasticity, shear, and fatigue.	Appropriate performance on student laboratory assessment or in-class exercises.
The engineer is involved with all the components of the construction system.		
Certain materials react differently under different types of strains and loads. Materials should be selected for certain applications as a result.		
A structure is only as strong as the material from which it is constructed.		

CONSTRUCTION ENGINEERING
GRADES 9-12

UNIT 2: CANTILEVER BEAMS

Objectives

Students will define a beam as a structural member.
Students will define a cantilevered beam.
Students will recognize common applications of cantilever beams.
Students will list advantages and disadvantages of cantilever beams.
Students will list important factors in a cantilevered beam's design.
Students will manipulate the problem-solving and design process including the statement of the problem, brainstorming, analysis, solution, prototype, and redesign.
Students will explain the importance of a go/no-go gauge.

Essential Questions

What requirements does a beam have to satisfy in order for it to be considered a cantilever beam?
What advantages and disadvantages do cantilever beams have in the construction industry?
Why is the depth of the cantilever beam an extremely important design consideration?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A cantilever beam is a unit that not only provides structural support to a structure, but aesthetic possibilities as well.	Based on set parameters, the student will design, construct and destructively test a cantilever beam. The student will then analyze and calculate the sag of the beam as related to its overall length. A lab report summarizing this activity will be generated.	Appropriate application of construction theory and problem-solving processes.
Created from a variety of materials, cantilevered structures can be found throughout any construction project.		
The depth of any structural member has a profound effect on its rigidity.		

CONSTRUCTION ENGINEERING
GRADES 9-12

UNIT 3: ROOF TRUSSES

Objectives

Students will explain the need for the roof system in the construction industry.
Students will define a truss.
Students will explain the concept of roof pitch and its effect on the structural and aesthetic qualities of a structure.
Students will perform basic roof pitch calculations.
Students will explain the need for, and use of gussets.
Students will list advantages as well as disadvantages of the roof truss system.

Essential Questions

What different processes can be used to construct pitched roofs in the construction industry?
How is "triangulation" applied not only to roof trusses, but also to other structural designs?
What is the function of the gusset in truss construction?
What are some advantages and disadvantages of the trussed roof?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Triangulation of materials is the most efficient means of reinforcing a structure.	Based on set parameters, students will design, construct, and destructively test both gusseted and non-gusseted truss pairs from exiting and student-generated designs. Students will then analyze the designs based upon strength-to-weight efficiency and structural efficiency calculations. A lab report summarizing this activity will be generated.	Appropriate application of construction theory and problem-solving processes.
The ability to create a structure with similar sized webbing will yield the most efficient truss work.		
The most efficient truss will be one in which tensile forces and compressive forces are paired in equilibrium.		
A truss will transfer loads effectively only if it acts as a single structural unit.		

CONSTRUCTION ENGINEERING
GRADES 9-12

UNIT 4: BRIDGES

Objectives
Students will explain the importance of bridges to society.
Students will explain the evolution of bridge design from ancient through modern day construction.
Students will define the various types of bridge designs.
Students will list and define the parts of a bridge such as the roadbed, superstructure, and substructure.
Students will relate design considerations for each type of bridge design.
Students will explain how environmental factors such as terrain and weather conditions can affect bridge design and choice of bridge type.

Essential Questions
Into what three categories can all bridge designs be divided?
What impact have bridges had on the economy, the military, our standard of living, recreation, etc.?
In what type of application is each of the three bridge types used?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Bridges are an integral part of any society's transportation infrastructure.	Based on set parameters, the students will design, construct, and destructively test a bridge design. The students will then analyze the structure based upon strength-to-weight efficiency and structural efficiency. A lab report summarizing the activity will be generated.	Appropriate application of construction theory and problem-solving processes.
No matter what type of bridge design is used, the primary goal of any structural supports, whether they are located in the substructure or the superstructure, is to stiffen and support the roadbed.		
Forces of tension and compression must be neutralized in any bridge design in order for the structure to avoid collapse.		

CONSTRUCTION ENGINEERING
GRADES 9-12

UNIT 5: MEMBRANE STRUCTURES / HYDRAULIC THEORY

Objectives

Students will explain the impact which membrane structures have had on construction.
Students will define the term “pneumatic structure” and “stretched structure”.
Students will list common materials used in the construction of membrane structures.
Students will list the advantages and disadvantages of stretched and pneumatic structures.
Students will define Pascal’s Law.
Students will explain the relationship of Force, Pressure, and Area.
Students will perform hydraulic word problems based on Pascal’s Law.

Essential Questions

How has the membrane structure evolved into the pneumatic structure of today?
What is the difference between a stretched structure and the pneumatic structure?
What is Pascal’s law, and how does it relate to hydraulic theory?
In what two ways can one increase force in a hydraulic system?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Membrane structures can be used as a semi-permanent, cost-effective alternative to large-scale construction.	Based on set parameters, the students will design, construct, and test an air-supported structure. The efficiency of the air lock, as well the pneumatic force generated, will be calculated. A lab report summarizing the activity will be generated. In addition, utilizing syringes, surgical tubing, the student will create a basic hydraulic system capable of performing a given task.	Appropriate application of construction theory and problem-solving processes. In addition, appropriate application of Pascal’s Law.
Hydraulic theory is dependent upon three variables: Force, Pressure, and Area. (Pascal’s Law).		
Tremendous changes in force can be generated by slight variations of Pressure and Area.		

CONSTRUCTION ENGINEERING
GRADES 9-12

UNIT 6: GEODESIC DOMES

Objectives
Students will define a geodesic dome.
Students will explain the origin and inventor of geodesic domes.
Students will provide examples of geodesic domes that are used in construction today.
Students will provide advantages and disadvantages for geodesic domes.
Students will analyze the engineering concepts on which the geodesic dome relies.

Essential Questions
Theoretically, how should a geodesic structure fail if the load were applied uniformly?
What is "frequency", and does it affect a dome's strength and aesthetics?
What impacts has the geodesic theory had on the construction industry?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The most efficient structures are those in which each structural member is loaded equally.	Based on set parameters, the students will design, construct, and destructively test a geodesic dome. The students will then analyze the structure based upon strength-to-weight efficiency and structural efficiency. A lab report summarizing the activity will be generated.	Appropriate application of construction theory and problem-solving processes.
The addition of more material doesn't necessarily make a structure more efficient.		
A structure which relies on triangulation for strength is only as strong as the its weakest link. (Joint, low quality material, etc.).		

CONSTRUCTION ENGINEERING
GRADES 9-12

UNIT 7: CONCRETE

Objectives
Students will explain the origin of concrete.
Students will list its principle components.
Students will identify the use of concrete in the construction industry.
Students will explain the engineering strengths and weaknesses of concrete as a construction material.
Students will summarize why "rebar" and wire mesh are used in the concrete's structure.

Essential Questions
What are the three primary ingredients to concrete? In what ratio?
What effect/s does adding more/less aggregate, water, or cement have on concrete's structure?
Why is concrete the material of choice for foundations?
Why is "re-bar" generally used in concrete?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The ratio of components in the concrete's mix can greatly affect its strength, cure time, and impact resistance.	Based on set parameters, students will construct three similar-sized concrete beams, each with different combinations of aggregate, water, cement, and reinforcement. The beams will then be destructively tested, and the results analyzed. A lab report summarizing the activity will be generated.	Appropriate application of construction theory and problem-solving processes.
The engineering properties associated with concrete greatly affect its application in the construction industry.		

CONSTRUCTION ENGINEERING
GRADES 9-12

RUBRIC

Group Name: _____ Date: _____

	Excellent (95)	Above Average (85)	Average (75)	Below Average (65)	No Attempt (0)
Background / Description	Student has thoroughly described the engineering concept and activity.	Student has explained the activity and concept, but left out some detail or support.	Student has either failed to mention the concept, or failed to explain the activity.	Student has either failed to mention either concept or activity, and the other was not explained fully.	
Data	Student has thoroughly explained the data and provided an adequate data chart.	Student has explained the data, and given a chart, but has omitted important details or information.	Student has either failed to explain the data, or failed to provide a data chart.	Student has either failed to explain data or provide a data chart, and the other was lacking in detail.	
Analysis	Student has thoroughly analyzed the project and provided a chart with results.	Student has attempted to analyze the project and provided a chart. More detail and/or thought required.	Student has either failed to analyze project, or failed to provide a chart.	Student has either failed to analyze project or failed to provide a chart. Remaining work is not detailed.	
Rating	Student has rated the activity, and provided adequate support for his/her rating. Explanation of improvements.	Student has rated the activity, and provided adequate support for his/her rating.	Student has rated the activity, but provided little support for his/her rating.	Student has rated the activity, but failed to support his/her rating.	

CONSTRUCTION ENGINEERING
GRADES 9-12

RESOURCES

Carpentry, Koel, Leonard. American Technical Publishers, Inc., Illinois.
Engineering Materials Properties and Selection, Budinski, K. Prentice Hall, New Jersey.

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: Introduction to Construction Materials and Properties	X	
Unit 2: Cantilever Beams	X	
Unit 3: Roof Trusses	X	
Unit 4: Bridges		X
Unit 5: Membrane Structures / Hydraulic Theory		X
Unit 6: Geodesic Domes		X
Unit 7: Concrete		X

INNOVATION IN ENGINEERING
GRADES 9-12

This course will cover advanced Engineering and problem solving strategies. Based upon that infamous scene from Apollo 13, "Houston, we have a problem," students will be given a box of items at the start of the semester which will be the only materials they will have to solve a variety of problems. These problems may include, but not be limited to: moving an object, building vehicles, designing and plumbing hydraulic systems, purifying water, and even generating and storing electrical energy. This class will be taught from a hands-on, problem solving approach, and is open to any student who has already taken Construction Engineering.

Prerequisite: Construction Engineering

Credit: 0.5

INNOVATION IN ENGINEERING
GRADES 9-12

UNIT 1: INTRODUCTION TO PROBLEM SOLVING AND DESIGN

Objectives

Students will define the concept of Engineering.
Students will explain the impact which Engineering has had on society, the economy, and history.
Students will identify different types of Engineers.
Students will identify the steps in the Problem Solving process.
Students will explain how Problem Solving is an applicable skill for the lifelong learner.
Students will explain the Design Process, and its role in Engineering and Problem Solving.

Essential Questions

What is the role of the engineer? How is his/her role related to the tradesperson?
How does an engineer solve problems?
What are the steps to be followed in order to perform successful problem solving?
How could we use problem solving skills in our adult life?
How can the Design Process be used to aid in Problem Solving?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The engineer is involved with all the components of the construction and manufacturing system.	Students will design and build a vehicle which will transport an egg safely from the top of the bleachers to the ground below. Students will apply not only Problem Solving skills, but also utilize the Design Process.	Successful implementation of the problem-solving process, as well as successful completion of vehicle.
Problem Solving requires certain steps to be followed in order to be successful.		
Problem solving is a transferrable lifelong skill.		
The Design Process is the roadmap which the Engineer follows when solving problems		

INNOVATION IN ENGINEERING
GRADES 9-12

UNIT 2: MATERIALS IN ENGINEERING

Objectives

Students will identify different types of materials used in manufacturing such as wood, ceramics, metals, and plastics.
Students will describe where certain materials are used in construction and for which applications.
Students will explain different stresses that a material can undergo.
Students will list and explain material properties such as tension, compression, elasticity, plasticity, toughness, fatigue, shear, and creep.
Students will identify different materials testing apparatus such as Tensile/Compression tester, hardness tester, etc.
Students will demonstrate how to use various measuring devices including but not limited to: Scales, Caliper, and Micrometer.

Essential Questions

What effect does a material's properties have on its application in manufacturing?
Is it possible to replicate real-world, conditional effects on materials in a laboratory test?
What are some outcomes resulting from faulty engineering?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
An understanding of different Materials, their properties, and testing, is essential for the engineer.	Students will take part in a laboratory experiment, where different stresses are applied to different materials, using an assortment of material testing devices.	Appropriate performance while utilizing materials testing processes.
Certain materials react differently under different types of strains and loads.		
Materials should be selected for certain applications as a result.		
A structure is only as strong as the material from which it is constructed.		

INNOVATION IN ENGINEERING
GRADES 9-12

UNIT #3: SAFETY

Objectives

Students will explain general safety rules as they apply to laboratory situations.
Students will discuss personal responsibility for individual and group safety.
Students will demonstrate knowledge of locations of emergency stop buttons, safety equipment, fire exits, and fire extinguishers.
Students will demonstrate the safe and appropriate use of hand and power tools.
Students will promote safe working practices on a daily basis.

Essential Questions

What are the dangers in performing material processing activities in the shop?
How can these dangers be reduced or eliminated?
Upon which trade or job position does responsibility lie for the safe performance, completion or quality of a given construction operation?
Why should laboratory safety be interpreted as a life-long skill?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Safety is a personal and a group responsibility. Material processing is an activity whose many dangers can be minimized with forethought and an appropriate attitude. Safety is everyone's concern.	Practice emergency drills for fire and injury. Instructor monitors continuously, and students practice mutual feedback for compliance with safety procedures. Lab practical activities which include safe tool use, appropriate methods and practices, and safely working in group situations.	Appropriate performance on student evaluation and/or classroom participation. Use of the Technology Education Department PLC safety unit to prepare and monitor student safety preparation and practice.

INNOVATION IN ENGINEERING
GRADES 9-12

UNIT 4: RE-CREATING THE WHEEL

Objectives

Students will explain the importance of taking risks and making mistakes.
Students will relate how analyzing failure can improve future performance.
Students will list examples of popular products which were once failures.
Students will re-design one project from last class, showing improvement on engineering design.

Essential Questions

Why do they put erasers on pencils?
What are some inventions which resulted from many failures? (WD-40, Post-it-Notes, etc.)

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Sometimes, the most learning evolves from failure.	As a class, students will choose one structure which they constructed in the prerequisite class. Once chosen, each student will have a limited time to post-engineer it, re-build it, and then test it. Results will be recorded and compared.	Students' improvement of the structure as compared to previous results.
The ability to analyze mistakes is essential to an Engineer's evolution.		

INNOVATION IN ENGINEERING
GRADES 9-12

UNIT 5: APOLLO 13 – TERRESTRIAL, MARINE, AND AEOROSPACE ENGINEERING

Objectives

Students will explain why an engineer may specialize within one realm of Engineering.
Students will explain why it would be important to diversify.
Students will explain why a Fluid Power Engineer would be considered a crossover Engineer.
Students will explain such terms as simple machine, mechanical advantage, efficiency, work, and resistance.
Students will explain the concept of gear ratio.

Essential Questions

What is the best motivation for successful Problem Solving?
What are some specific Engineering practices employed by Marine Engineers? Aerospace Engineers? Terrestrial Engineers?
Would there be any crossover engineering between Marine and Aviation realms? (Aerodynamics, Hydrodynamics

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Some of the best Problem Solving arises out of need or survival. Engineering can be specific to certain realms: Land, Sea, Air, Space, or Bio Tech. Each realm of Engineering has its inherent traits and specialties.	Groups of students will each be given a box of similar materials. These materials are all that each group will have in order to solve various problems throughout the unit. Possible problems may include the following: ***Fling It*** – Students will be asked to propel a projectile with accuracy, landing on or around a target Zone. ***Bombs Away*** – Students will have to find a way to lower a specified load onto a landing zone in a controlled and safe manner. ***Fast and Furious*** – Students must make a vehicle which will run the fastest, straightest and farthest. ***Displace This*** – Student will have to fabricate a vessel which will displace a pre-determined load. ***Dyin'-of-Thirst*** – Students will have to determine a way to filter out impurities from drinking water.	Appropriate application of construction theory and problem-solving processes.

INNOVATION IN ENGINEERING
GRADES 9-12

UNIT 6: FLUID POWER

Objectives

Students will identify the two mediums defined by "Fluid Power" .
Students will define Pascal's Law.
Students will explain Bernoulli's Principle.
Students will explain the relationship of Force, Pressure, and Area.
Students will perform hydraulic word problems based on Pascal's Law.
Students will explain the impact Fluid Power has had on today's technologies.

Essential Questions

Why is compressed gas used in a shock absorber, and not liquid?
What is meant by Fluid Power?
What is Pascal's law, and how does it relate to hydraulic theory?
In what two ways can one increase force in a hydraulic system?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Liquid is virtually incompressible, while air is extremely compressible. Hydraulic theory is dependent upon three variables: Force, Pressure, and Area. (Pascal's Law) Tremendous changes in force can be generated by slight variations of Pressure and Area. Fluid Power has made the application of impossible forces, possible.	Groups of students will each be given a box of similar materials. These materials are all that each group will have in order to solve various problems throughout the unit. Possible problems may include the following: ***Movin' on Up*** – Students will grasp a teacher-supplied object, and then move it to a higher position in the room, using a fluid-powered machine. Students may experiment with air or water as the medium. ***Incra-MENTAL*** – Students will have to move a device in a controlled series of pre-determined increments. Each increment has to be accurate and uniform. Students may experiment with water or air as the medium.	Appropriate application of construction theory and problem-solving processes. In addition, appropriate application of Pascal's Law.

INNOVATION IN ENGINEERING
GRADES 9-12

UNIT 7: ALTERNATIVE ENERGY

Objectives

Students will relate how most of our energy is produced in the world today?
Students will explain why Connecticut doesn't have more Wind-powered energy?
Students will explain Ohm's Law, wattage, AC/DC, series circuits, parallel circuits, and resistance.
Students will demonstrate the use and function of different electrical testing equipment.
Students will provide advantages and disadvantages of Alternative Energy resources.
Students will analyze electrical power generation.
Students will identify the principles of thermodynamics.

Essential Questions

Why are alternative energy resources so under-utilized today?
What permanent effects have energy sources left on our environment?
How does a step-up transformer work?
What is the difference between AC and DC?
How is electricity generated?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Many sources of energy are finite. Alternative energy can harness virtually untapped resources. Many underutilized energy sources can provide power with little, if any, harmful pollutants or by-products. OHM's Law states a relationship between Voltage, Current, and Resistance. An electrical generator, and an electric motor are very similar devices.	Groups of students will each be given a box of similar materials. These materials are all that each group will have in order to solve various problems throughout the unit. Possible problems may include the following: ***I've Got the Power*** – Students will generate and store electrical energy. ***One Potato – Two Potato*** – Students will generate electricity through the use of dissimilar metals and an electrolyte. ***Here Comes the Sun***- Students will learn different ways to harness and utilize solar power. ***A Salt and Battery***- Students will experiment with different ways to create batteries for storage of electricity.	Appropriate application of construction theory and problem-solving processes.

INNOVATION IN ENGINEERING
GRADES 9-12
RESOURCES

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: Intro to Problem Solving/Design	X	
Unit 2: Materials in Engineering	X	
Unit 3: Safety	X	
Unit 4: Re-Creating the Wheel	X	
Unit 5: Apollo 13- Engineering	X	>
Unit 6: Fluid Power		X
Unit 7: Alternative Energy		X

RESIDENTIAL CONSTRUCTION
GRADES 9-12

This course is designed to introduce the student to the highly technical and profitable world of residential construction. Major emphasis will be placed on design, layout of lumber, construction principles and practices, the importance of simple geometry and mathematics skills as well as hands-on lab work. Students will be instructed from a hands-on, problem solving approach. It is the aim of this course to complete a storage shed or similar project work as a class project.

Credit: 0.5

RESIDENTIAL CONSTRUCTION
GRADES 9-12

UNIT 1: GENERAL SAFETY

Objectives

Students will define some of the safety concerns in a construction lab including personal safety equipment.
Students will describe and demonstrate the procedures related to workplace and job-site safety including personal protective equipment, machine safety, and material handling practices.
Students will discuss personal responsibility for individual and group safety practices in the work areas.
Students will indicate the locations of emergency stop buttons, exits, exit routes, eyewash station, first aid kit, and firefighting equipment.
Students will discuss information on OSHA, EPA, MSDS sheets and other safety regulations as it relates to proper use and storage of hazardous materials and chemicals.
Students will be able to describe safe practices and demonstrate use of the tools and equipment used in the construction lab.

Essential Questions

What are the dangers in performing construction activities in the shop?
Why is tool and equipment safety important in a working environment?
How can these dangers be reduced or eliminated? Are there governmental controls used in construction?
Upon which trade or job position does responsibility lie for the safe performance, completion or quality of a given construction operation?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Safety is a personal and a group responsibility. Construction is an occupation whose many dangers can be minimized with forethought and an appropriate attitude.	Practice emergency drills for fire and injury. Students will pass a prescribed safety instruction unit before using the lab, tools, or equipment. Instructor monitors continuously, and students practice mutual feedback for compliance with safety procedures.	Appropriate performance on student evaluation and/or classroom participation. Use of the safety unit to prepare and monitor student safety preparation and practices.

RESIDENTIAL CONSTRUCTION
GRADES 9-12

UNIT 2: MEASUREMENT, LAYOUT AND DESIGN

Objectives

Students will measure and divide wall lengths for stud, door and window spacing.
Students will be able to describe and identify fractional measurements from a basic plan and assembly drawings and measure accurately to a sixteenth of an inch.
Students will describe and prepare rough drawings and sketches.
Students will be able to explain and prepare a cut list or bill of material from a basic plan and assembly drawing.
Students will interpret a design to facilitate replication.
Students will identify the difference between both nominal and actual dimensions.
Students will project measurements around objects.
Students will explain the relationship of diagonal lengths to squareness of rectangles and racking of walls.
Students will use simple "Pythagorean" ratios to layout large rectangles.
Students will discuss the process by which one trade's work affects sequential trades' activities.
Students will recognize the information presented on a set of plans.
Students will create a bill of materials that shows materials needed and proper board footage and linear footage.
Students will have an understanding kerf and its application to cutting and layout operations.

Essential Questions

What techniques ensure accurate layout for building?
Why is accurate layout, and good quality construction, necessary?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Efficient building requires good planning. Good quality group results demand individual responsibility. Accurate measurement is essential in the building trades.	Student crews crosscheck each other's layouts. Students will use measuring and layout tools to complete a sample construction layout. The quality of the work on earlier procedures is indicated by any corrections necessary, or adjustments required, before performing the next sequential task.	Appropriate performance on student evaluation and/or classroom participation.

RESIDENTIAL CONSTRUCTION
GRADES 9-12

UNIT 3: DESIGN, ENVIRONMENTAL, HUMAN, AND FINANCIAL FACTORS

Objectives

Students will recognize desirable factors in land shape and orientation.
Students will discuss how design relates to comfort and costs.
Students will describe how housing needs may change over a lifetime.
Students will correlate human variety with design needs. Describe the phases of residential and commercial construction.
Students will develop an understanding of local, state and global building and construction issues using critical and creative thinking skills; logical reasoning; analytical thinking and problem solving techniques.
Students will describe the economic implications of using problem-solving and critical thinking skills to improve a situation or process.
Students will create ideas, proposals, and solutions to building construction problems.
Students will evaluate ideas, proposals, and solutions to building construction problems.
Students will generate new and creative building construction ideas to solve problems using a structured problem solving method.

Essential Questions

What makes a good site for construction, or a good residence?
What are the effects of going "green" when constructing a building?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Community and individuals work together to produce a civil society.	Analysis and critique of various construction design examples. Production of designs according to criteria presented. Analysis and critique of various construction sub-systems used in residential construction.	Appropriate performance on student evaluation and/or classroom participation.
Planning results in efficiency of effort and cost in construction, and in comfort, utility and ease of maintenance in the finished product.		

RESIDENTIAL CONSTRUCTION
GRADES 9-12

UNIT 4: PERMITS, INSPECTIONS, AND LEGALITIES

Objectives

Students will discuss the interplay of individual and community interests in residential construction.
Students will correlate the phases of construction with the concerns of governing bodies.
Students will describe the inspections required during the construction process.
Students will explain and demonstrate site layout procedures.
Student's will be able to describe the phases of residential and commercial construction.

Essential Questions

Why do communities regulate construction activities?
What do communities require of the builder?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Construction is a community endeavor, with individual consequences.	Lab practical, including completion of Town of Waterford requests for building permits.	Appropriate performance on student evaluation and/or classroom participation.
Community interests impose restrictions on construction activities.	Group construction of site plans and framing diagrams for construction of class project.	

RESIDENTIAL CONSTRUCTION
GRADES 9-12

UNIT 5: TOOLS, EQUIPMENT, AND METHODS OF SAFE USE

Objectives

Students will demonstrate the safe use of layout and measuring tools.
Students will demonstrate the safe use of hand tools used in construction.
Students will demonstrate the safe use of portable power tools used in construction.
Students will demonstrate the safe use of stationary power equipment used in construction.
Students will correlate the dangers of construction with methods to minimize their severity.
Students will create a structure according to normal residential construction practices.
Students will be able to describe safety practices for the following machines: table saw, drill press, stationary sander, router table, and miter saw.

Essential Questions

How can a builder reduce or eliminate the dangers inherent in the construction process?
What tools are available to the builder, and how are they used?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Safety depends on knowledge and attitude.	Lab practical activities include safe tool use, methods and processes, and working in small and large groups with others.	Appropriate performance on student evaluation and/or classroom participation.
The proper use of appropriate tools results in greater efficiency and safety.		

RESIDENTIAL CONSTRUCTION
GRADES 9-12

UNIT 6: BUILDING MATERIALS AND CONSTRUCTION RESOURCES

Objectives

Students will compare different applications and characteristics of hardwoods, softwoods and engineered lumber used in construction systems.
Students will identify different wood joinery used in construction and prepare stocks for use in construction.
Students will how grain direction affects cutting and strength of building materials.
Students will identify and describe the purpose and use of the following woodworking fasteners: common nails, round head screws, flat head screws, and oval head screws.
Students will identify adhesives and abrasives used in construction.
Students will identify the types and uses of clamping devices.
Students will identify various wood finishes for interior and exterior use in construction.
Students will identify and incorporate various building systems in their construction design projects.
Students will access some construction-related data online.
Students will be able to identify subsystems, sub-contractors, as well as some other sources of information useful to the builder.

Essential Questions

Where can the builders, or prospective builder, find the information he/she needs?
How can various building materials affect the construction project?
Do builders need any special certifications from the city, town or state to operate a construction company?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Several systems exist for the construction of foundations, floors, walls and roofs, electric, plumbing, heating and ventilation, etc. each with its own assets and liabilities.	Small group reports to the class on alternative systems to those used in the class project. Participate in construction projects in groups that relate to all phases of residential construction. Reports to the class on construction-related information available through community sources, commercial sources, and the internet.	Appropriate performance on student evaluation and/or classroom participation.
Information is an important and valuable tool in the construction industry, and much of it costs only the effort of research.		

RESIDENTIAL CONSTRUCTION
GRADES 9-12

UNIT 7: MATERIALS, TECHNOLOGICAL CHANGES, AND CAREERS

Objectives

Students will discuss the potential of some emerging materials and processes.
Students will describe some historical changes in materials and methods of construction.
Students will correlate demographic and life cycle changes to the construction process.
Students will identify and appraise the impacts construction has on their future aspirations; both career based and/or as an educated consumer.
Students will develop career goals and objectives as part of a plan for future career direction.
Students will develop strategies to reach career objectives.
Students will compare the advantages and disadvantages of different types of home purchases, additions, renovations and repairs

Essential Questions

What future changes in housing requirements can be expected and/or predicted?
What emerging materials promise to meet future construction needs?
What new building initiatives are taking place locally or on the state level?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Technological, personal and demographic changes demand a lifetime of readiness to learn.	The students will give individual or small group reports to the class on innovations in construction methods, materials, careers in construction or systems.	Appropriate performance on student evaluation and/or classroom participation.
The construction field is changing to use resources more wisely and efficiently.		

RESIDENTIAL CONSTRUCTION
GRADES 9-12
SHOP SAFETY RUBRIC

Content/Skill	1 Excellent	2 Very Proficient	3 Proficient	2 Approaching Proficiency	1 Lacking Proficiency	Score
Student completion of Safety handout and worksheet.	Safety handout was effectively and appropriately completed.	Safety handout was completed with few inaccuracies.	Safety handout was completed with inaccuracies present.	Safety handout was attempted and or completed with many inaccuracies	Safety handout was never attempted	
Student performance on individual safety evaluation.	Student completed evaluation and shows excellent synthesis of all material and concepts.	Student completed evaluation and shows a synthesis of all material and concepts.	Student completed evaluation and shows adequate synthesis of all material and concepts.	Student completed evaluation and shows minimal synthesis of all material and concepts.	Student completed evaluation and shows little or no synthesis of all material and concepts.	
Student demonstrates application of safety practices in the lab.	Student always demonstrates appropriate safety practices to successfully accomplish a task.	Student frequently demonstrates appropriate safety practices to successfully accomplish a task.	Student usually demonstrates appropriate safety practices to successfully accomplish a task.	Student sometimes demonstrates appropriate safety practices to successfully accomplish a task.	Student rarely demonstrates appropriate safety practices to successfully accomplish a task.	

RESIDENTIAL CONSTRUCTION
GRADES 9-12

RESOURCES

Safety: handout and worksheet, lesson, video, test
Measurement: lesson and worksheet, tools which include: rulers, scales, tape measures, squares and pencils
Design lesson
Use of internet for research
Town of Waterford building permit forms
Planning and Zoning regulations
Tools and equipment lesson
Lab, tools and equipment
Community resources
Town offices
Internet research on construction materials
Material testing

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: General Safety	X	
Unit 2: Measurement and Layout	X	
Unit 3: Design, Environmental, Human, and Financial Factors	X	
Unit 4: Permits, Inspections, and Legalities	X	
Unit 5: Tools, Equipment, and Methods of Safe Use	X	
Unit 6: Construction Systems and Information Resources	X	>
Unit 7: Materials, Technological Changes, and Future Methods		X

FUNDAMENTALS OF LAND SURVEYING
GRADES 9-12

This semester course, geared toward the students with interests in engineering, construction, and/or mathematics, will introduce them to the technical and profitable career of the land surveyor. Students will learn basic land surveying principles, the use and care of instruments and tools, and finally how to use collected fieldwork to solve basic problems and/or generate maps. Emphasis will be placed on performing horizontal, vertical and angular measurement, setting up and running a basic traverse, and solving practical real-world surveying problems such as laying out a baseball diamond, staking out a foundation, or transferring an elevation. This course is taught from a hands-on, problem solving approach and is open to all students who have completed the prerequisite. Much of the fieldwork in this course will be collected by the student on school grounds.

Prerequisite: Algebra or Geometry

Credit: 0.5

FUNDAMENTALS OF LAND SURVEYING
GRADES 9-12

UNIT 1: INTRODUCTION / ORIENTATION TO LAND SURVEYING

Objectives

Students will define the role of the surveyor in the construction and engineering field.
Students will list various types of surveys required to be performed by the surveyor.
Students will explain the various jobs which the surveyor performs in order to produce an accurate, legal, and reliable survey.
Students will explain the historical significance of the surveying field.
Students will list related occupations.

Essential Questions

Why do civilized societies employ land surveyors?
What type of tasks will a land surveyor be expected to perform?
How important is a working understanding of real estate law to the land surveyor?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The land surveyor is an integral part of any construction system.	Students will work in groups in order to establish the perceived role of the land surveyor. Students will then brainstorm together in order to determine the scope for a course such as this. The groups will finally share their ideas in a class discussion.	Appropriate use of surveying terms and basic surveying equipment.
Many different types of surveys can be performed, each with specific outcomes.		
Much of the land surveyor's job entails legal issues both in setting land boundaries and in settling boundary disputes.		

FUNDAMENTALS OF LAND SURVEYING
GRADES 9-12

UNIT 2: SURVEYING MEASUREMENT

Objectives

Students will define accuracy and precision, and then explain how they are related.
Students will list the types of measurements which a surveyor records in the field.
Students will explain the basic forms of surveying reference.
Students will perform conversion from bearing to azimuth and azimuth to bearing.
Students will perform conversion from degree measurement with minutes and seconds to degree measurement with decimal rounding and degree measurement with decimal rounding to degree measurement with minutes and seconds.

Essential Questions

What problems can develop if a survey is not accurate and/or precise?
Basically, what two types of measurements do surveyors record?
When measurements are taken in the field, how are they described so they can be used in the future?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Only through the use of accurate measurement can one map the earth.	Students will perform various calculations showing conversion from bearing to azimuth measurements and azimuth to bearing measurements. Next, students will demonstrate understanding of degree and decimal conversions of angular measures by completing an assigned worksheet.	Appropriate performance on lab exercises, and classroom participation.
When measurements are taken over large distances, error is magnified.		
The surveyor deals with two types of measurement; Linear and Angular.		
In order for a surveyor to transfer measurements from the field to a map, known points of reference must be utilized.		

FUNDAMENTALS OF LAND SURVEYING
GRADES 9-12

UNIT 3: NOTE KEEPING, INSTRUMENTATION, AND TRIGONOMETRIC CONVERSION

Objectives

Students will list the five requirements of acceptable surveying notes.
Students will explain the importance of keeping an accurate, orderly field book.
Students will accurately set up and manipulate basic surveyor's tools and instruments.
Students will read and record data using basic surveyor's instruments.
Students will apply the laws of sine, cosine and tangent in order to solve basic right angle, trigonometric problems.

Essential Questions

Why is such care taken when recording field notes?
What effect/s does improper instrument set up have on the rest of the surveying process?
How does a surveyor ensure the accuracy of his/her instruments?
What role does mathematics play in the application and analysis of surveying measurement?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Only a notebook which is accurate and complete can be used as a legally-binding surveying document.	Students will solve basic surveying problems by applying the laws of sine, cosine, and tangent, Pythagorean Theorem, and Standard Deviation. Students will be given sample problem data, and will also be required to record other necessary problem data utilizing surveying instruments. Students may also apply their trigonometry skill in order to inspect and ensure that the school's baseball field is laid out precisely, and to CIAC specifications.	Appropriate application of trigonometric function throughout rest of course.
Using a standard notebook format ensures consistency throughout all surveying references.		
A measurement recorded in the field is only as accurate as the instrument's set up and reading.		
Mathematic functions and formulas are the means by which recorded measurements are converted to usable data.		
Surveying is the study of applied mathematics.		

FUNDAMENTALS OF LAND SURVEYING
GRADES 9-12

UNIT 4: HORIZONTAL MEASUREMENT

Objectives

Students will demonstrate the need for and application of accurate horizontal distance readings in land surveying.
Students will determine their own Pace, and then apply it to measuring distances in the field.
Students will list various tools used to record horizontal distances in the field.
Students will explain the difference between horizontal and slope distance.
Students will demonstrate and explain proper taping technique.
Students will apply mathematic corrections to readings in order to maintain precision in measurement.
Students will set up and utilize the Electronic Distance Measurement (EDM) total station to record highly accurate slope and horizontal distances.

Essential Questions

Why are horizontal measurements so important?
What are some ways in which horizontal distances can be recorded?
If a tract of land is severely sloped, in what ways can horizontal measurements be recorded?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
There are many ways in which to record linear distances.	Students will measure several pre-determined horizontal distances using the Pacing method. Next, the same horizontal distances will be measured utilizing the surveyor's tape and plumb bob, and results compared. Students will then perform various taping operations on sloped surfaces. The horizontal distances will then be recorded through both "breaking tape" as well as mathematic conversion from sloped measurements. Finally, students will observe how measurements, both horizontal and sloped, can be recorded and/or converted using an Electronic Distance Measurement (EDM) total station.	Appropriate performance on student evaluation and/or classroom participation.
In a plane survey, regardless of a location's topography, horizontal distances are the only true length to be applied to a map's orthographic frame of reference.		
When taping, horizontal measurements may be applied directly to a map, while slope distances must first be mathematically converted to horizontal distance.		

FUNDAMENTALS OF LAND SURVEYING
GRADES 9-12

UNIT 5: VERTICAL MEASUREMENT

Objectives

Students will define and apply terms relating to vertical distances.
Students will list basic tools used in the collection and analysis of vertical measurement.
Students will explain techniques used to perform leveling operations.
Students will carry a known elevation through a series of stations in order to determine the elevation of a random location.
Students will properly record and analyze data throughout a leveling operation.
Students will check a set of differential leveling notes for accuracy.
Students will explain how to apply basic leveling techniques to residential, commercial, and civil construction.

Essential Questions

How is elevation carried from a point of known elevation to the building site?
When carrying an elevation with a level, why is the Backsight always added to an existing elevation, while the Foresight is always subtracted?
What factors would influence the surveyor's choice of set up locations on a differential leveling run?
How is the initial elevation determined when starting a differential leveling operation?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A working knowledge of surveying terms and abbreviations is vital in order for a surveying party to communicate effectively.	Students will be given a basic, incomplete set of differential leveling notes, and will complete them by calculating for the missing data from that which was given. Finally, the students will set up and perform a differential leveling run between a point of known elevation, and a teacher-selected termination point. The elevation will be carried throughout the run, and the elevation of the terminal point will be calculated and checked for error.	Appropriate use of surveying concepts and practices.
An existing, known elevation can be "carried" from its existing location to any point on the earth's surface using basic surveying instruments and basic mathematic calculations.		
In any construction endeavor, the surveyor is responsible for locating the structure at a pre-determined, engineered elevation, as referenced from known points of elevation.		
In a leveling operation, as in any surveying endeavor, field data must be mathematically checked before it can be accepted as fact.		

FUNDAMENTALS OF LAND SURVEYING
GRADES 9-12

UNIT 6: ANGULAR MEASUREMENT

Objectives

Students will differentiate among the different angles measured with the transit and/or total station.
Students will explain the relationship between azimuths and bearings.
Students will establish station points and install hubs.
Students will properly record and check single and doubled angles.
Students will explain the use of a transit as opposed to a builder's level.
Students will set up and run a course consisting of multiple hubs, while recording necessary data.
Students will perform appropriate checks to analyze and compensate for error.

Essential Questions

What units of measurement are used when recording angles?
When locating hubs for a run, what factors determine appropriate locations?
How can angular measurements be checked while in the field?
What differences are there between an engineer's transit and a builder's level?
What are the specific roles of the survey party members?
What are some causes for inaccuracies in angular measurement?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The surveyor must possess a working knowledge of geometric and trigonometric principles in order to accurately record and analyze angular measurements.	Students will set up hubs at necessary station points on an arbitrary survey run. Students will then accurately set up over each hub, and record the necessary angle between them. Survey teams will work in opposite directions over the same hub, and their readings will be checked. Finally, all angles will be mathematically balanced.	Appropriate use of surveying concepts and practices.
Accuracy in instrument set up determines accuracy in recorded data.		
Doubling an angle is the most accurate means by which to check the accuracy of the angular measure.		
No matter how accurate the recorded data, all measurements must be mathematically balanced.		

FUNDAMENTALS OF LAND SURVEYING
GRADES 9-12

UNIT 7: THE TRAVERSE

Objectives

Students will explain the use of the traverse as a means of horizontal control.
Students will differentiate between a loop and a connecting traverse, then between an open and a closed traverse.
Students will explain the role elevation plays in a traverse survey.
Students will list and perform the steps required in setting up and running a closed loop traverse.
Students will define the responsibilities of each member of the survey crew.
Students will define three ways of recording sloped distances.
Students will balance the angles of the traverse.
Students will calculate the error of closure, as related to latitude and departure.
Students will generate a balanced, scaled map of the traverse utilizing True North as the reference.

Essential Questions

Why is a traverse used in order to locate existing boundary points?
When locating hubs for a run, what factors determine appropriate locations?
Why must the first reading be shot off a Backsight of known location and elevation?
What is "leap frogging", and why is it used to help maintain the accuracy of traverse measurement?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The traverse is a means of *horizontal control*.	Utilizing all the knowledge and skills acquired in the class to date, the students will first locate hubs for the traverse needed to reference existing boundary markers. The students will then set up instruments including the engineer's transit and EDM total station in order to record data. The information will be compiled into the surveyor's notebook, checked, and balanced. Finally, a map showing the traverse and boundaries of the property will be compiled.	Successful layout of a basic traverse on school grounds.
The closed, loop traverse is the easiest type of traverse to work with because all readings can be mathematically checked and balanced.		
Both horizontal and vertical measurements are recorded when performing a traverse.		
Typically, property markers and other known points are located by referencing them in relation to the stations of the traverse.		
The traverse and its measurements are the foundation for map generation.		

FUNDAMENTALS OF LAND SURVEYING
GRADES 9-12
DIFFERENTIAL LEVELING CRITERIA / GRADING

Name: _____ Date: _____

	A (95)	B (85)	C (75)	D (65)	F (55)
Sketch / Drawing	Drawing is neat and accurate, contains all relevant information.	Drawing contains all relevant information, but is not neatly done.	Drawing is not neat, it is hard to follow, and contains inaccuracies.	Drawing is useless, does not communicate effectively.	Drawing has not been attempted.
Field Notes	Field notes are complete, neat, and contain all necessary data.	Field notes are complete, contain all necessary data, but are not neat.	Field notes are hard to follow, and do not contain some necessary data.	Field notes are hard to read, hard to follow, and do not contain much needed data.	Field notes not attempted.
Mathematic Analysis	All data has been analyzed accurately with appropriate mathematic procedures.	Data has been analyzed with appropriate mathematic procedures, but contain minor errors.	Data has been attempted to be analyzed, but may contain inaccuracies, and/or mistakes in the use of mathematic procedures.	Inappropriate mathematic procedures were attempted, and inaccuracies were noted, resulting in incorrect analysis.	Mathematic analysis not attempted.

FUNDAMENTALS OF LAND SURVEYING
GRADES 9-12

RESOURCES

Surveying, Principles and Applications, Kavanagh, B.F. Upper Saddle River: Prentice Hall.

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: Introduction / Orientation to Land Surveying	X	
Unit 2: Surveying Measurement	X	
Unit 3: Note Keeping, Instrumentation, and Trigonometric Conversion	X	
Unit 4: Horizontal Measurement	X	
Unit 5: Vertical Measurement		X
Unit 6: Angular Measurement		X
Unit 7: The Traverse		X

STATE OF CONNECTICUT TECHNOLOGY EDUCATION STANDARDS

COMPUTER AIDED DRAFTING & DESIGN (CADD) (GRADES 9-12)

CADD.01	**Demonstrate an understanding of the historical and current events related to CADD and the impact on society.**
CADD.01.01	Develop a timeline showing important periods that have significance to CADD and explain the impact on society.
CADD.01.02	Evaluate current events that have relevance to process digital information.
CADD.01.03	Describe the development of graphic language in a digital age.
CADD.01.04	Explain the significance of the development Computer Aided Drafting and Design had on society.
CADD.02	**Analyze the use of current CADD design technology.**
CADD.02.01	Apply conventional Computer Aided Drafting and Design processes and procedures accurately, appropriately, and safely.
CADD.02.02	Describe physical objects as geometric entities.*
CADD.02.03	Describe and demonstrate the process of using a mechanical or electronic caliper accurately as required by the design intent.*(A2)
CADD.02.04	Describe and demonstrate the use of graphic communication skills through sketching.*(A3)
CADD.02.05	Evaluate and select appropriate method of communication for a given problem.*
CADD.02.06	Send and access information through a network.*(A4)
CADD.02.07	Express a design of an object as a 3D model.*(A5)
CADD.02.08	Export and import images/files in a variety of file formats*(A6)
CADD.02.09	Evaluate the choice and placement of dimensions, notes and annotations to clearly communicate design intent.*(A7)
CADD.02.10	Revise a design and update finished drawings appropriately.*(A8)
CADD.02.11	Identify basic geometric elements (e.g., line, circle, rectangle, sphere, and cube).*(A9)
CADD.02.12	Describe objects as geometric entities.*(A1)
CADD.02.13	Describe and apply the following basic geometric concepts to building 3D models: tangent and parallel concentric.*(A10)
CADD.03	**Utilize measurement and annotation systems as they apply to CADD technology design.**
CADD.03.01	Explain how the various measurement systems are used in CADD drawings.
CADD.03.02	Describe the measurement standards used in the manufacturing industry.
CADD.03.03	Determine the proper dimensioning styles for a variety of applications.
CADD.03.04	Apply dimensioning to various objects and features.
CADD.03.05	Edit a dimension by using various editing methods.
CADD.03.06	Demonstrate the processes of lettering and text editing.

CADD.03.07	Develop drawings using notes and specifications.
CADD.03.08	Demonstrate the methods of creating a title block.
CADD.04	**Identify, describe, and utilize the basic hardware and operating systems used in CADD.**
CADD.04.01	Identify and describe various types of hardware and software.*(B11)
CADD.04.02	Identify and describe the purpose of operating system components.*(B12)
CADD.04.03	Define and apply computer terminology*(B13)
CADD.04.04	View file names of a storage device.*(C14)
CADD.04.05	Store, copy, move, and retrieve information to/from various drives.*(C15)
CADD.04.06	Rename and backup files*C16)
CADD.04.07	Identify the hardware requirements of a given CADD software package.
CADD.05	**Utilize Proper projection techniques to develop orthographic and pictorial drawings.**
CADD.05.01	Understand the commands and concepts necessary for producing drawings through traditional or computer-aided means.
CADD.05.02	Understand the orthographic projection process for developing multi-view drawings.
CADD.05.03	Differentiate the various techniques for viewing objects.
CADD.05.04	Use the concepts of geometric construction in the development of design drawings.
CADD.05.05	Create orthographic, isometric, section, and auxiliary views.(E25)
CADD.05.06	Explain the Cartesian Coordinate System.*(E20)
CADD.05.07	Describe the process for setting and editing drawing elements.*(E21)
CADD.05.08	Create and edit line types, colors and layers/levels.*(E22)
CADD.05.09	Create and edit basic geometry.*(E23)
CADD.05.10	Place and edit text and fonts.*(E24)
CADD.05.11	Explain and demonstrate the process for creating orthographic, isometric, section views, and auxiliary view.*
CADD.05.12	Place and edit dimensions.*(E26)
CADD.05.13	Generate a 2-D multi-view drawing.*(E27)
CADD.05.14	Generate a pictorial drawing.*(E28)
CADD.05.15	Scale and print hard copy of an output device.*(E29)
CADD.05.16	Explain the use and need for scaled drawings.*(E30)
CADD.06	**Demonstrate use and application of alternate view applications and functions.**

CADD.06.01 Identify the function of alternate views.
CADD.06.02 Demonstrate the use of cutting planes to clarify hidden features of an object.
CADD.06.03 Create and edit construction planes through reference geometry.*(G35)
CADD.06.04 Generate/modify geometric components on construction planes.*
CADD.06.05 Create a 2-D drawing from a 3-D model.*(G34)
CADD.06.06 Create a 3-D model from a 2-D drawing.*(G35)

CADD.07 Create assemblies and views in 3-D format.

CADD.07.01 Create an assembly in 3-D geometry.*(F31)
CADD.07.02 Create an exploded view of a 3-D assembly.*(F32)

CADD.08 Explain and Utilize the concepts of sketching and the sketching process used in preliminary design and development.

CADD.08.01 Produce proportional two- and three-dimensional sketches and designs.
CADD.08.02 Use sketching techniques as they apply to a variety of objects.
CADD.08.03 Use freehand graphic communication skills to represent conceptual ideas, analysis, and design concepts.
CADD.08.04 Explain the purpose of sketching and how it applies to design.

CADD.09 Identify various symbols to interpret and read technical drawings.

CADD.09.01 Interpret basic views and dimensions in a working drawing.*(D17)
CADD.09.02 Identify geometric tolerance symbols.*(D18)
CADD.09.03 Interpret drawings, pictures, and symbols.*(D19)

CADD.10 Maintain a portfolio to document knowledge, skills, materials and experience in CADD.

CADD.10.01 Gather educational and work highlights to include in portfolio.
CADD.10.02 Organize and provide a compact disc, web site and/or other digital media for use in demonstrating knowledge, skills, and experience.
CADD.10.03 Prepare and conduct effective portfolio oral presentation(s).

ENGINEERING TECHNOLOGY (GRADES 9-12)

ENG.01 Identify the roles, responsibilities and requirements of engineering.

ENG.01.01 Describe the following engineering fields: mechanical, chemical, civil, and electrical.*(A1)

ENG.01.02	Identify the following job functions and responsibilities: research and development, design, production, supervision, management, testing, and analysis in mechanical, chemical, civil, and electrical engineering. *(A2)
ENG.01.03	Identify the following educational requirements in engineering: associate, bachelor, master, and doctorate degrees.*(A3)
ENG.01.04	Describe the employment opportunities of an engineer.
ENG.01.05	Describe ethics related to engineering in the following situations: environmental, sustainable engineering, and corrupt practices.*(A4)
ENG.02	**Use the design process to solve problems by creating and refining prototypes.**
ENG.02.01	Identify the components of the design process: define the problem, brainstorm, research, develop solutions, prototype, test/evaluate, and communicate results.*(H25)
ENG.02.02	Identify the elements of a well-written problem statement.*(H26)
ENG.02.03	Describe the process for researching relevant information.*(H28)
ENG.02.04	Describe the process of brainstorming.*(H27)
ENG.02.05	Brainstorm possible solutions.
ENG.02.06	Analyze and research between alternate solutions.
ENG.02.07	Describe the process of developing a solution.*(H29)
ENG.02.08	Develop details of a solution.
ENG.02.09	Build a prototype from working drawings using appropriate materials.*(H30)
ENG.02.10	Test prototype to defined criteria.*(H31)
ENG.02.11	Redesign prototypes.
ENG.02.12	Communicate processes and results.
ENG.02.13	Use a variety of productivity software to explain the results of the design process, including, spreadsheets, word processing, data analysis, and presentations.*(H32)
ENG.03	**Ensure quality control using the major components of manufacturing processes including measurement systems, tools and instruments to produce a product.**
ENG.03.01	Explain the major manufacturing processes.
ENG.03.02	Explain the following quality controls: geometric dimensioning and tolerances, and go-no go gauge.*(E12)
ENG.03.03	Use the following measurement tools and instruments: rulers, micrometers, and Vernier calipers.*(E13)
ENG.03.04	Explain quality control.
ENG.03.05	Identify the following elementary statistical process controls: distribution curves, normal curves, and skew curves.*(E14)

STATE OF CONNECTICUT TECHNOLOGY EDUCATION STANDARDS

ENG.04	**Design using the appropriate materials in engineering by identifying. Comparing, selecting and testing.**
ENG.04.01	Identify common materials used in engineering.
ENG.04.02	Describe the following mechanical properties of steel, concrete, wood, and plastic: ductility/brittleness, tension, shear, and compression.*(D9)
ENG.04.03	Test materials for specific characteristics.*(D11)
ENG.04.04	Explain the process used for selecting the correct materials for specific functions.*(D10)
ENG.05	**Works collaboratively in engineering teams throughout the design process.**
ENG.05.01	Read and understand design documentation and technical manuals.
ENG.05.02	Write technical reports.
ENG.05.03	Make an oral presentation.
ENG.05.04	Actively contribute to a team project.
ENG.05.05	Identify the following characteristics of an effective design team: team norms, leadership, responsibility, respect, rapport, and time management.*(C8)
ENG.05.06	Identify the roles and responsibilities of the following engineering design team members: team leader, designers, reporters, testers, and fabricators.*(C7)
ENG.06	**Use engineering equipment, laboratory materials and tools appropriately and safely.**
ENG.06.01	Describe the function of a safety device.
ENG.06.02	Demonstrate safe personal behavior in the classroom.
ENG.06.03	Use all tools and equipment safely
ENG.06.04	Describe and demonstrate the proper use of engineering laboratory equipment.*(B6)
ENG.06.05	Describe and demonstrate the components of personal and group laboratory safety.
ENG.06.06	Describe and use safety laboratory equipment.
ENG.06.07	Explain and demonstrate the proper use of personal protective equipment (PPE).*(B5)
ENG.07	**Identify and demonstrate the use of various software programs used in the engineering field.**
ENG.07.01	Identify available resources for researching problem solutions.*(F15)
ENG.07.02	Use word processing software to develop reports.*(F16)
ENG.07.03	Use presentation software to develop oral presentation of findings.*(F17)
ENG.07.04	Describe and demonstrate the process for using CAD in a design solution.*(F18)
ENG.07.05	Use spreadsheet software to develop tables, graphs and charts and track data.*(F19)

STATE OF CONNECTICUT TECHNOLOGY EDUCATION STANDARDS

ENG.08	**Demonstrate the application of science and math principles to the electrical engineering process.**
ENG.08.02	Describe and apply the following electricity principles: Ohm's, Watt's, series, parallel, combination circuits, AC/DC systems, and conductors/insulators.*(G22)
ENG.08.03	Use appropriate electrical units to solve problems.
ENG.08.04	Draw a circuit diagram and lay out the circuit.
ENG.08.05	Describe work in electrical systems.
ENG.08.06	Explain rate in electrical systems.
ENG.08.07	Describe resistance in electrical systems.
ENG.09	**Demonstrate the application of science and math principles to the fluids engineering process.**
ENG.09.01	Identify what causes resistance in a fluid system.
ENG.09.02	Describe the following components and applications of fluid power principles: reservoir, fluid conductors, valves, pumps, actuators, Pascal's Law, and Bernoulli's Principle.*(G23)
ENG.09.03	Describe components of hydraulic and pneumatic systems.
ENG.09.04	Describe work in electrical, mechanical, fluid and thermal systems.
ENG.09.05	Explain rate in electrical, mechanical, fluid and thermal systems.
ENG.09.06	Describe resistance in electrical, mechanical, fluid and thermal systems.
ENG.10	**Demonstrate the application of science and math principles to the thermal engineering process.**
ENG.10.01	Identify the three ways heat is transferred.
ENG.10.02	Describe the following principles and applications of thermodynamics: heat flow and transfer, convection, conduction, radiation, temperature scales, and conductors/insulators.*(G24)
ENG.10.03	Solve thermal problems using appropriate units.
ENG.10.04	Describe work in thermal systems.
ENG.10.05	Explain rate in thermal systems.
ENG.10.06	Describe resistance in thermal systems.
ENG.11	**Demonstrate the application of science and math principles to the mechanical engineering process.**
ENG.11.01	Describe and apply the following mechanical systems principles: Law of Conservation of Energy, six simple machines, mechanical advantage, efficiency, work, rate, and friction/resistance.(G21)
ENG.11.02	Solve problems using appropriate units in engineering systems.

ENG.11.03 Describe and apply the following statics principles: vectoring to predict resultant forces, equilibrium, trusses, and moment of inertia.*(G20)

ENG.11.04 Explain the effects of gear ratios.

ENG.11.05 Describe work in mechanical systems.

ENG.11.06 Explain rate in mechanical systems.

ENG.11.07 Describe resistance in mechanical systems.

ARCHITECTURE TECHNOLOGY (GRADES 9-12)

ARCH.01 Identify significant historical events and trends that have impacted architecture.

ARCH.01.01 Discuss current trends in commercial and residential architecture.

ARCH.01.02 Research and differentiate between design periods that shaped todays structures.

ARCH.02 Demonstrate an understanding of socio-cultural and environmental impacts on architectural design.

ARCH.02.01 Identify how location, resources and materials influence design.

ARCH.02.02 Differentiate between human wants and needs.

ARCH.02.03 Apply "Green" building practices to project design.

ARCH.02.04 Apply culture, community and diversity needs to project design

ARCH.03 Demonstrate an understanding of regulations in architectural design.

ARCH.03.01 Research and identify regulations and codes that are needed to establish a legal and safe design.

ARCH.03.02 Evaluate a site that takes into consideration local, state and national restrictions, zoning and codes.

ARCH.03.03 Differentiate between residential and commercial building codes/standards.

ARCH.03.04 Develop an understanding of the American Disability Act.

ARCH.04 Apply principles of physics in selecting and working with materials and load applications

ARCH.04.01 Explain various forces that bear on, and within, structures.

ARCH.04.02 Analyze architectural physics of soil mechanics, foundation design, and engineering material as they relate to structural design.

ARCH.04.03 Demonstrate an understanding of static and dynamic loads as they relate to a structure.

ARCH.04.04 Develop and communicate an assigned building design.

ARCH.05 Research, plan and design functional structure.

ARCH.05.01 Apply prior knowledge to discuss daily needs and influences identified in their environment.

ARCH.05.02 Produce preliminary designs, final sketches and presentation drawings.
ARCH.05.03 Utilize commercial and residential suggestions and specifications to create functional floor plans.
ARCH.05.04 Utilize an architectural drawing to estimate the cost and the materials necessary for a project.

ARCH.06 Develop technical drawings drafted by hand and computer aided drafting and design (CADD).

ARCH.06.01 Identify, research, develop and explain architectural and construction plans, drawings, diagrams and specifications.
ARCH.06.02 Draw and sketch by hand to communicate ideas effectively.
ARCH.06.03 Utilize CADD software to produce technical drawings and architectural proposals.

ARCH.07 Employ appropriate media to communicate concepts and design.

ARCH.07.01 Convey information using multi-dimensional drawings.
ARCH.07.02 Create effective working drawings, and presentation drawing.
ARCH.07.03 Employ basic model building techniques.

ARCH.08 Maintain a portfolio to document knowledge, skills and experience in architecture.

ARCH.08.01 Research and Collect data that relates to architectural drafting and design
ARCH.08.02 Select and organize appropriate examples that demonstrate knowledge, skills and experience.
ARCH.08.04 Prepare and conduct effective oral presentation.

BUILDING CONSTRUCTION (GRADES 9-12)

BC.01 Identify and appraise the impacts construction has on their future aspirations; both career based and/or as an educated consumer.

BC.01.01 Develop career goals and objectives as part of a plan for future career direction.
BC.01.02 Develop strategies to reach career objectives.
BC.01.03 Compare the advantages and disadvantages of different types of home purchases, additions, renovations and repairs.

BC.02 Describe and demonstrate the procedures related to workplace and job-site safety including personal protective equipment, machine safety, and material handling practices.

BC.02.01 Demonstrate safe material handling practices.
BC.02.02 Demonstrate and explain knowledge of workplace safety procedures.*(A2)
BC.02.03 Demonstrate and explain knowledge of personal safety practices pertaining to eye wear, footwear, clothing, and personal protective equipment (PPE) used in wood technology.*(A3)
BC.02.04 Describe safety practices for the following machines: table saw, drill press, stationary sander, router table, and miter saw.*(A4)

BC.02.05	Demonstrate and explain knowledge of proper use and storage of basic hand tools.*(A5)
BC.02.06	Demonstrate and explain knowledge of proper use and storage of portable power tools.*(A6)
BC.02.07	Evaluate workplace/jobsite activities for compliance with governmental and other applicable safety regulations such as EPA and OSHA.
BC.02.08	Read and discuss information on OSHA, EPA and other safety regulations.
BC.02.09	Obtain, understand and follow MSDS (Material Safety Data Sheets) information.
BC.02.10	Explain safe proper use, disposal, and storage of chemicals following OSHA standards.*(A7)
BC.02.11	Demonstrate knowledge of proper use, storage, and disposal of hazardous materials following OSHA's proper safety practices for a woodworking facility.*(A1)
BC.03	**Identify and describe the safe and appropriate use of various types of layout, hand and power tools and machinery used for building construction.**
BC.03.01	Identify, use, and maintain the following measuring, layout, and marking tools steel rule, tape measure, combination square, sliding "T" bevel, and compass.*(B8)
BC.03.02	Identify proper use and function of the following portable power tools: circular saw, drill, jig/saber saw, finishing sanders, and routers.*(B9)
BC.03.03	Identify proper use and function of the following fastening tools: hammer, Phillip head screw driver, and slotted/flat head screw driver.*(B10)
BC.03.04	Identify proper use and function of portable power tools.
BC.03.05	Identify proper use and function of the following hand tools: cross cut saw, rip saw, level, coping saw, nail set, hand plane, chisel, and file.*(B11)
BC.03.06	Identify proper use and function of the table and miter saws.*(B12)
BC.03.07	Identify the proper use and function specialty machinery (e.g., drill presses, jointers, surface planers, table saws, power miter saws, band saws, scroll saws, and stationary sanders.
BC.03.08	Explain correct use of planers.
BC.03.09	Explain use of molders.
BC.03.10	Identify functions and demonstrate us of wood lathes.
BC.03.11	Identify and demonstrate use and function of sanders.
BC.04	**Understand and be able to demonstrate the methods involved in turning materials into useable structures and products.**
BC.04.01	Describe and identify fractional measurements from a basic plan and assembly drawings.*(C13)
BC.04.02	Describe and prepare rough drawings and sketches.*(C14)

BC.04.03	Explain and prepare a cut list or bill of material from a basic plan and assembly drawing.*(C15)
BC.04.04	Interpret a design to facilitate replication
BC.04.05	Measure accurately to a sixteenth of an inch.*(C16)
BC.04.06	Identify the difference between both nominal and actual dimensions.*(C17)
BC.04.07	Explain and use fractional dimensions.
BC.04.08	Extrapolate information from a set of plans.
BC.04.09	Consider the natural characteristics of grain, knots, and checks when laying out a board.*(C19)
BC.04.10	Estimate materials quantities in both board feet and linear feet.*(C18)
BC.04.11	Identify various types of joints.
BC.04.12	Prepare stock for use.*(G28)
BC.04.13	Identify and assemble the following types of joints: butt, miter, dado, rabbet, and lap.*(G27)
BC.04.14	Identify and describe the purpose and use of the following woodworking fasteners: common nails, round head screws, flat head screws, and oval head screws.
BC.04.15	Identify, describe purpose of and use woodworking adhesives.
BC.04.16	Identify and describe the purpose of the following clamping devices: bar clamp, c clamp, parallel/hand screw clamp, and spring clamps.*(H30)
BC.04.17	Identify and apply various wood finishes for interior and exterior, with brush or wipe on, for the following: paint, stain, and clear coat.*(I31)
BC.04.18	Describe the abrasive grit numbering grading system.*(F26)
BC.04.19	Differentiate among various abrasive materials.
BC.04.20	Identify and select the proper cutting process based on grain direction.*(E23)
BC.04.21	Identify how grain direction affects a material's strength.*(E24)
BC.04.22	Understanding kerf and its application to cutting and layout operations.*(E25)
BC.05	**Describe characteristics and determine appropriate applications for various building material selections.**
BC.05.01	Identify characteristics and applications of the following coniferous softwoods: pine, cedar, and fir.*(D20)
BC.05.02	Identify characteristics and applications of the following deciduous hardwoods: oak, maple, and poplar.*(D21)
BC.05.03	Identify characteristics and applications of the following engineered lumber: plywood and medium density fiberboard.*(D22)
BC.05.04	Identify building systems needed to complete a construction project.
BC.05.05	List all building systems involved in a project.

BC.05.06	Identify and describe the function of the components of building systems needed to complete a construction project.
BC.05.07	Incorporate appropriate building systems into a construction project.
BC.05.08	Develop building plans and schedules by using processes common to residential and commercial construction.
BC.05.09	Explain the sub-systems, (e.g., structural, electrical, mechanical, finish, foundations) appropriate to the architectural design and residential construction.
BC.05.10	Explain and demonstrate site layout procedures.
BC.05.11	Describe the phases of residential and commercial construction.
BC.06	**Develop an understanding of local, state and global building and construction issues using critical and creative thinking skills; logical reasoning; analytical thinking and problem solving techniques.**
BC.06.01	Describe the economic implications of using problem-solving and critical thinking skills to improve a situation or process.
BC.06.02	Create ideas, proposals, and solutions to building construction problems.
BC.06.03	Evaluate ideas, proposals, and solutions to building construction problems.
BC.06.04	Generate new and creative building construction ideas to solve problems using a structured problem solving method.

PHOTOGRAPHY
GRADES 9-12

This course will serve as an introduction for the beginning photographer. Students will learn how to use cameras and make photographic prints. The course includes 35mm black and white film and darkroom technology as well as state-of-the-art digital camera and computer digital image enhancement technologies. Students will demonstrate their abilities by producing photographs for specific assigned challenges and then compose a photo album to display their work.

Credit: 0.5

PHOTOGRAPHY
GRADES 9-12

UNIT 1: THE BASICS OF DIGITAL PHOTOGRAPHY

Objectives

Students will properly use a digital camera to create quality photographs.
Students will download captured digital images onto their computer.
Students will utilize Photoshop digital enhancement software to enhance the image.
Students will program the Desk Jet printer to create photographic prints.
Students will use an engineering approach to problem solving to help them successfully complete assigned weekly photo challenges.

Essential Questions

What is the basis for digital photography?
How does a digital camera work?
What is a Mega pixel and how do pixels work to capture images?
How do you download digital images onto the computer?
How do you save the images on the computer?
How do you enhance the digital images?
What are the advantages of digital photography over film photography?
Does film photography have any advantages over digital?
What elements should be considered to capture a quality image?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Digital photography is fun and easy to do.	Each student will follow an engineering approach to problem solving to help them to become successful in finding the solution to a weekly photo challenge.	The teacher will use a rubric to assess student performance in completing their Technology Systems Model worksheet along with the quality of the photo he/she submits for the assigned weekly photo challenges.
Digital photography can be practiced as a life-long hobby that can be done at home for very little cost.		
Mega pixel means one million pixels.		
The more mega pixels the camera has the better the resolution of the image and the more expensive the camera.		
A digital camera is nothing more than a portable hand held scanner.		

PHOTOGRAPHY
GRADES 9-12

UNIT 2: PHOTOSHOP DIGITAL ENHANCEMENT SOFTWARE

Objectives
Students will use basic Photographic digital enhancement software to modify their images on the computer before printing them in the form of a photograph.

Essential Questions
What does digital enhancement software actually do?
What is Photoshop digital enhancement?
What basic Photoshop techniques do photographers employ to process their images?
How do you properly save the enhanced images on your computer?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Anyone can use a digital camera, enhance the images on their home computer, and make their own prints.	Students will alter their digital images on the computer using Photoshop software and then print the enhanced image to satisfy an assigned weekly photo challenge.	The teacher will use a rubric to assess student on how well they used Photoshop to enhance their picture.
Digital photography is a lot of fun and easy to do.		

PHOTOGRAPHY
GRADES 9-12

UNIT 3: PRINTING DIGITAL IMAGES

Objectives
Students will follow a step by step process to produce a photographic print.
Students will be able to produce professional quality digital photographs utilizing their own digital camera, personal computer, and DeskJet printer.

Essential Questions
What is the procedure for printing digital images from the computer?
What kind of printer and print paper do you need to produce photographic prints?
How do you trim and mount a photograph?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
They can process and print their own photos, for low cost, out of their own homes.	Students will process their own pictures and make prints for each week's assignment.	Each student will produce a photo for each weeks assignment which is evidence of their following the process.
Digital photography is fun and easy to do.		

PHOTOGRAPHY
GRADES 9-12

UNIT 4: TECHNOLOGY SYSTEMS MODEL

Objectives
Students will follow an engineering approach to problem solving that will assist them in achieving their goals.

Essential Questions
What is the Technology Systems Model and how do you use it to solve assigned photography problems?
How can the Technology Systems Model be used to solve any problem in life?
What are the only two reasons for failing to achieve your goal?
How can you assure success in achieving a desired goal.

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The Technology systems model is an engineering approach to solving problems and, if implemented properly, can be used to solve any problem in life.	Students will complete a Technology Systems Model worksheet with each assignment to help them to be successful when solving any problem.	The teacher will use a rubric to assess student performance in completing their Technology Systems Model worksheet along with the quality of the photo he/she submits for the assigned weekly photo challenge. Students will use a rubric to analyze and critique their own performance.
The only two reasons for anyone failing to reach his/her goals in life is setting a goal that is unrealistic and/or quitting.		
Everyone has control over his/her future if they choose to take control of it.		

PHOTOGRAPHY
GRADES 9-12

PHOTOGRAPHY GROUP PROJECT RUBRIC

	95 Exceptional	85 Proficient	75 Minimal	65 Inadequate	55 – 0	Score
Communicate in Standard English	The group accurately completed their report using proper spelling and grammar.	The group mostly completed their report and/or made several spelling and grammar mistakes.	The group partially completed their report and/or made many spelling and/or grammar mistakes.	The group either made a poor attempt at completing their report and/or utilized unacceptable spelling and grammar.	The group failed to complete the report.	
Read and understand a variety of materials	Students have searched the internet and have provided exceptional research for the report.	Students have searched the internet and have included proficient research in their report.	Students have searched the internet but have only included minimal research in their report.	Students did inadequate research to complete their report.	The group failed to provide adequate research for the report.	
Apply scientific principles to solve problems	The group fully understands how to utilize the Technology Systems Model to solve the problem.	The group has a good understanding of how to use the Technology Systems Model to solve the problem	Students have a partial understanding of how to use the Technology Systems Model to solve the problem.	The group displayed a poor understanding of how to use the Technology Systems Model to solve the problem	The group failed to follow the technology systems model.	
Utilizes technology to organize and solve problems	The group showed exceptional skill levels in utilizing all photography equipment and technologies.	The group showed good skill levels in utilizing all photography equipment and technologies to complete their project.	The group displayed partial skill levels in utilizing the photography equipment and technologies to complete their project.	The group displayed little skill in using photography equipment and technologies to complete their project.	The group displayed extreme difficulty in utilizing technology.	

PHOTOGRAPHY
GRADES 9-12

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: The Basics Digital Photography	X	
Unit 2: Photoshop Digital Enhancement		X
Unit 3: Technology Systems Model	X	
Unit 4: Printing Digital Images		X

ADVANCED PHOTOGRAPHY
GRADES 9-12

This course is designed for students who have a serious interest in pursuing photography as a life-long hobby or career. Students will perfect their picture taking skills using a professional quality DSLR camera, and enhance the images using Photoshop and enter the solution to an assigned weekly photo challenge in a friendly competition with their classmates to determine the photo of the week.

Prerequisite: Photography

Credit: 0.5

ADVANCED PHOTOGRAPHY
GRADES 9-12

UNIT 1: HOW TO TAKE A PROFESSIONAL QUALITY PHOTOGRAPH

Objectives

Students will understand how to properly adjust a DSLR camera to achieve desired results.
Students will produce professional quality photos.
Students will be knowledgeable of career opportunities in the field of photography.

Essential Questions

What camera adjusts can be made to achieve desired results?
What is the technology systems model and how does it work to solve problems?
What are the only two reasons for failure?
What is Photoshop and what is it used for?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
	Students will enhance their skills by using a variety of Photoshop techniques to alter their digital images on the computer using Photoshop software and produce a photographic print that will be submitted into a competition to determine the photo of the week.	Appropriate performance on assigned photo challenges.
It takes extensive training and a lot of practice to take professional quality photographs.		
Taking professional quality photographs combines picture taking skills with advanced digital enhancement techniques, marrying photography with art.		
Practice makes perfect.		

ADVANCED PHOTOGRAPHY
GRADES 9-12

UNIT 2: ADVANCED PHOTOSHOP SKILLS

Objectives
Students will utilize several different methods to create a selection in order to create a layer using Photoshop.
Students will modify and arrange the layers to enhance the image.
Students will create layer masks to embellish the image.
Students will use advanced Photoshop techniques to create digitally enhanced the image.

Essential Questions
What are the different ways of getting a good selection using Photoshop?
What Photoshop tools are most the useful?
What are layers and how are they used in Photoshop to enhance a digital image?
What is a layer mask and how are they used in Photoshop to embellish a digital image?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Photoshop is a professional quality digital enhancement software program that is used to create digitally enhanced images.	Students will digital alter their image using a variety of Photoshop techniques and then create a photographic print and submit it into a competition with their classmates.	Appropriate performance on student evaluation and/or classroom participation.
State of the art digital photography combines picture taking skills with digital enhancement techniques, thus marrying photography to art		
It takes extensive training and years of practice to become a Photoshop technician.		
It takes extensive training and years of practice to become a professional Photographer.		

ADVANCED PHOTOGRAPHY
GRADES 9-12

PHOTO ASSIGNMENT RUBRIC

	95 Exceptional	85 Proficient	75 Minimal	65 Inadequate	55 – 0	Student Evaluation	Teacher Evaluation
Communicate in Standard English	Student accurately completed the photo project worksheet using proper spelling and English grammar.	Student has mostly completed the photo project worksheet and/or has made some spelling and grammar mistakes.	Student has partially completed the photo project worksheet and/or has made many spelling and grammar mistakes.	Student has either made a poor attempt at completing the photo worksheet or has utilized unacceptable spelling and grammar.	Deduct 5 points for each class assignment is late.		
Read and understand a variety of materials	Student has searched the internet and has recorded four websites on the worksheet as benchmarks to challenge and test their abilities prior to planning their picture solution.	Student has searched the internet and has recorded three websites as benchmark sources prior to planning their picture solution.	Student has searched the internet, and has recorded only two websites, or has done the research after the photo was taken.	Student has searched the internet, but has recorded only one website.	Research not done.		
Evaluate information to interpret events and make informed responses	Student has evaluated his/her photo project solution and has an excellent idea of what could have been done differently to get better results next time, and has accurately assessed his/her own performance within 10 points.	Student has a good understanding of what could have been done differently to get better results, but no a total understanding, and has assessed his/her own performance within 11-20 points.	Student has a partial understanding of what could have been done differently to get better results, and/or has assessed his/her own performance within 21-30 points.	Student has little understanding of what could have been done differently to get better results, and/or has assessed his/her own performance more than 31 points different from the teacher's grade.	Evaluation not done.		
Apply scientific principles to solve problems	Student fully understands and utilizes the Technology Systems Model to solve assigned problems, and applies the proper scientific principles.	Student has a good understanding of the Technology Systems Model, has adequately followed the process in completing the assigned problem, and mostly applies the proper scientific principles.	Student has a partial understanding of the Technology Systems Model, and has only partially completed the problem worksheet, and understands basic scientific principles.	Student has little or no understanding of the Technology Systems Model, has done little to complete the problem worksheet, and does not understand how to apply basic scientific principles.	Technology Systems Model worksheet not completed.		
Utilize technology to organize and solve problems	Student shows exceptional skills in utilizing all photography equipment and technologies, and has produced an exceptional photograph.	Student shows exceptional skills in utilizing all photography equipment and technologies, and has produced a good photograph.	Student shows partial skills in utilizing all photography equipment and technologies and/or has produced a fair photograph.	Student shows little skill utilizing all photography equipment and technologies, and/or has produced a poor photograph.	Student has not produced a photo.		
					Total Score		
					Score/5 = Grade %		

ADVANCED PHOTOGRAPHY
GRADES 9-12

RESOURCES

Photoshop CS Down and Dirty Tricks, Scott Kelby, New Riders Publishing, 2004.

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: How to Take Professional Quality Photographs	X	
Unit 2: Advanced Photoshop Skills		X

COMPUTER SCIENCE
GRADES 9-12

In this course, students can acquire a fundamental understanding of the operation of computers and computer networks, and create programs implementing simple algorithms. The development of useful computer programs and program modules is used as a context for introducing other important concepts in computer science, including the development and use of fundamental data structures, computer applications, and insight into the design of the human/computer interface. Exposure to career possibilities and discussion of ethical issues relating to computers will also be important threads in this course.

Credit: 0.5

COMPUTER SCIENCE
GRADES 9-12

UNIT 1: INTRODUCTION TO COMPUTER SCIENCE

Objectives

Students will describe the relationship between computer hardware and software.
Students will explain the basic components of a computer system.
Students will be able to describe the importance of an operating system, and list various types.
Students will describe how hardware components execute programs and manage data.
Students will describe different types of storage devices.
Students will explain how information is represented both in a computer's memory, as well as in execution.
Students will explain the importance of the flowchart format.
Students will discuss the ethics of responsible computer usage as it pertains both to application as well as software development.
Students will list various careers utilizing Computer Science.

Essential Questions

What are the basic components of any computer system?
Are there any careers available which will not include use of computer technology?
Why is a flowchart used for sketching computer programs?
Why have we seen an increase in unethical computer use(social media, viruses, hacking) in modern society?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A computer system is a symbiotic relationship between hardware and software structures.	Students will be active participants in both class discussions, as well as laboratory activities. Activities may include tracing prepared coding projects, tutorials, or labs.	Successful application of basic computer processes and nomenclature.
The easiest way to sketch a computer's processing, is through the use of a flowchart.		
Today's use of computer technology can either positively or negatively affect the fabric of today's global society.		
A basic understanding of computer systems is a necessary skill in the today's workplace.		

COMPUTER SCIENCE
GRADES 9-12

UNIT 2: HOW COMPUTERS ARE PROGRAMMED

Objectives

Students will explain the importance of Binary code in the past, current, and future computer systems.
Students will explain the function of a Programming Language.
Students will explain the role which the following play in the programming process.: Assemblers, compilers, interpreters, and operating systems.
Students will explain the five steps in the programming process.
Students will manipulate a basic programming language, utilizing either a compiler or an interpreter.

Essential Questions

How do we convert binary code to a language which can be understood by the programmer?
What is the difference between a programming language and an operating system?
Can code be written to make computers intuitive?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Binary code represents the textual structure on which a computer's processor communicates.	Students will create a basic program using one of several available programming languages. Examples to include: JAVA, C++, Scratch, or Jeroo.	Successful function of a basic program.
Programming languages provide the medium through which computer programming code and humans can effectively communicate.		
The computer's operating system manages the fundamental operations of the computer.		
The structure of a basic program is important, and must be sketched before implementing.		

COMPUTER SCIENCE
GRADES 9-12

UNIT 3: PROBLEM SOLVING AND ALGORITHMS

Objectives

Students will be able to explain the problem solving and decision making processes.
Students will be able to define the term algorithm, and explain how it relates to computer programming.
Students will be able to apply algorithms to flow charting a basic computer program.
Students will be able to explain how an algorithm allows a computer to produce a target output after specific input is applied.
Students will be able to read a well-documented algorithm.

Essential Questions

What are the elements of the problem solving processes?
Are algorithms programming language specific?
How does a flow chart assist algorithmic programming?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The problems solving process involves systematically defining the problem, then making decisions for acceptable solutions.	Students will be instructed to apply the problem-solving process to basic programming issues. Students will then be instructed on graphically describing the process through a flow chart.	Students' generation and application of algorithmic flow charts.
Most computer programming can be observed to be rooted in the basic mathematic algorithm.		
A flow chart is a symbolic drawing of the problem solving process.		

COMPUTER SCIENCE
GRADES 9-12

UNIT 4: CREATING AND RUNNING A COMPUTER PROGRAM

Objectives

Students will explain how rules of grammar in a spoken language are similar to syntax in a programming language.
Students will explain the importance of a program statement.
Students will relate the relationship between: Attribute and behavior, class and object, behaviors and methods.
Students will explain what is meant by a data field.
Students will be able to apply an escape sequence to a basic program.
Students will differentiate between variables and constants.

Essential Questions

Is computer language similar to spoken or written human language? How?
Why is syntax so important when writing code for a computer program?
In what ways are computer science related to mathematics?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
All programming languages follow the same basic informational processes.	Students will use a programming language to create several functioning computer programs which will utilize different variables. Problems must be analyzed, then fixed.	Successful function of a computer program utilizing different fields and variables.
Syntax and case sensitivity are critical, and text must be proofread carefully, or debugging must then be applied at a later time.		
There are many variables which affect the success or function of a program.		
Logic is the most basic skill needed when creating computer programs.		

COMPUTER SCIENCE
GRADES 9-12

UNIT 5: DECISION MAKING AND STRINGS

Objectives

Students will explore the ability of the computer program to make decisions.
Students will be able to differentiate between a strings and arrays.
Students will be able to write declaration statements for string variables.
Students will be able to explain the difference between a string and an array of characters.
Students will explain how mathematic operations relate to computer programming language.
Students will explain the importance of the "If-Then" expression in programming.
Students will differentiate between a string literal and a string object.

Essential Questions

How does a computer program give the appearance of making logical decisions?
How are strings able to help a program include or exclude certain data?
How can string commands be used to write an application program?
Can a string be used to provide security to a computer program?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
If-Then logic structures are the basis for programming strings.	Students will write basic programs which will incorporate string data. As a result students will see the interrelatedness of logic, algebra, and computer science.	Successful application of string data in a functional program.
Relational operators such as less than, greater than, equal, greater than or equal to, etc., can be used to compare logical conditions.		
Algebraic concepts of inequalities relate to programming strings.		
A string is that element in a program which can define boundaries for the user.		

COMPUTER SCIENCE
GRADES 9-12

UNIT 6: NETWORKING

Objectives

Students will be able to explain the need for computer networks.
Students will define the different types of computer networks.
Students will be able to differentiate between the terms *client* and *server*.
Students will be able to differentiate between Providing and Consuming.
Students will recognize differences between wired and wireless networks.

Essential Questions

What is the role of a server?
What security issues are inherent in Peer to Peer network?
Can a network be setup in any location, with any computer configuration?
What type of server is the most common in today's workplace?
What is the difference between a WAN and a Lan?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
Through the use of a network, expensive storage and peripheral devices can be shared among many clients	Students will research the advantages/disadvantages of different types of computer networks found today. Students will each generate a power point show and present to the class.	Successful presentation of assigned topic.
The type of network needed is based on several factors, including geographic proximity, security needs, equipment/software budget or needs, and number of clients.		
Data backup is more convenient and secure on a network as compared to individual workstations.		

COMPUTER SCIENCE
GRADES 9-12
RESOURCES

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: Introduction to Computer Science	X	
Unit 2: How Computers are Programmed	X	
Unit 3: Problem Solving and Algorithms	X	
Unit 4: Creating and Running a Computer Program	X	X
Unit 5: Decision Making and Strings		X
Unit 6: Networking		X

MOBILE COMPUTER SCIENCE
GRADES 9-12

In this course, the high school student will learn computer science principles by building socially useful mobile apps. In addition to programming and computer science principles, this project-based course emphasizes writing, collaboration, communication, and creativity. Students will also learn to analyze the target audience and user profile, so important when designing a new app. Exposure to the mobile app industry, career possibilities, and discussion of ethical issues relating to computers will also be important threads in this course.

Credit: 0.5

MOBILE COMPUTER SCIENCE
GRADES 9-12

UNIT 1: INTRODUCTION TO MOBILE APP DEVELOPMENT

Objectives

Students will be able to discuss the advantages of mobile apps over programs on home computers.
Students will be able to describe careers and opportunities in the field of mobile app development.
Students will be able to differentiate between various mobile platforms.
Students will be able to differentiate between the two major operating systems, Android OS and Apple iOS, then explain their advantages and disadvantages.
Students will be able to describe the history of Android and Opensource.
Students will be able to describe the attributes of a successful app.

Essential Questions

How important are mobile apps on the current and future social, economic, and recreational needs of people?
How are mobile apps similar? What are inherent differences among them?
What traits make an app successful?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The creation of mobile apps is a burgeoning career which is only restrained by the inventor's imagination.	Students will be taught using several methodologies. Direct instruction, student-created Power Point presentations, and group-led practice will be used.	Students will present assigned research to the class. Examples will include "most useful app", "traits of a quality app", and others. Students will then develop an idea for an app, then present it to the class.
While there are several operating systems running today's mobile devices, two are the most popular: Android OS and Apple iOS.		
All good apps have several inherent characteristics: Connectivity, convenience, localization, reachability, security, and personalization.		

MOBILE COMPUTER SCIENCE
GRADES 9-12

UNIT 2: MOBILE APP PROGRAMMING BASICS

Objectives

Students will be able to explain how basic computer programming relates to mobile app development.
Students will explain why android-based apps use Java.
Students will be able to demonstrate how to create a basic computer program including variables, methods, control structures, data support, and user input.
Students will explain what is meant by debugging, and how to apply it within a mobile app program.
Students will create a text-based mobile game app.

Essential Questions

How will a basic understanding of computer programming help a mobile app developer become successful?
Why is Java the preferred programming language for the Android mobile app?
Is a basic mobile app hard to develop? A complex one?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
A mobile app is nothing more than a basic, or even complex, computer program which is specifically made for download to a mobile device.	Students will be exposed to both direct instruction, as well as performance-based learning. Students will be exposed to Java, Eclipse, and JDK.	Students will develop a functional text-based mobile app.
Java is the preferred programming language for use on Android apps because it is a known language, less prone to error, works with all mobile device platforms, and it is able to read native codes.		
Complex mobile apps are nothing more than several basic programs running as one.		

MOBILE COMPUTER SCIENCE
GRADES 9-12

UNIT 3: ANDROID APPLICATIONS

Objectives

Students will demonstrate a basic understanding of Android operation.
Students will explore different software packages such as SDK, SDK Eclipse, and SQLite, which will aid in the creation of more complex mobile apps.
Students will explore advanced app development features such as buttons, refactoring, graphics, debugging, and values.
Students will create various useful mobile apps which will include advanced operations.
Students will explore the development mobile app games.

Essential Questions

How can different software development programs aid in developing an individual app?
Once a basic understanding of mobile app development is achieved, is a programmer able to create useful mobile app for profit?
What is the career outlook for a mobile app developer?

Knowledge and Skills	Instructional Strategies	Evidence of Learning
The use of various program development software programs may be necessary to the creation of a final product.	Students will be exploring the creation of mobile app development utilizing different software packages. Students will be performing both hands-on programming, as well as online research of mobile applications.	Students will begin by creating simple, functional mobile apps, then will evolve into creating several apps which will require different graphical and user interfaces . By the end of this unit, the student will be able to independently develop most apps.
Once basic skills are learned and then compiled, very complex mobile apps can be developed.		
The continuation of new and creative mobile applications will evolve in the future, and will utilize new technologies to make them even more useful, fast, and suitable to human needs.		

MOBILE COMPUTER SCIENCE
GRADES 9-12
RESOURCES

PACING GUIDE

Unit	Quarter 1	Quarter 2
Unit 1: Introduction to Mobile App Development	X	
Unit 2: Mobile App Programming Basics	X	
Unit 3: Android Applications		X